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DIRECTED WIRELESS IMPULSES.

At brief intervals the secular press brings reports of sensational improvements in wireless telegraphy which we usually pigeonhole as "important, if true," a category which still lurks in our sanctum in spite of the all-pervading tendency to publish as fact and deny afterward if necessary. This time it is a report from abroad laid at the door of Dr. Braun, and charging him with a device to secure directive action in wireless sending so that the message goes to its intended destination and nowhere else. If such action could be secured it would be of great importance both in preventing interference and in economizing energy. But until the modus operandi is made public we can form very little idea as to the probable truth of the report. Of course, electric waves of all lengths can conceivably be reflected so as to produce the effect of a searchlight streaming invisible rays into space. But one cannot produce directed reflection save from surfaces of dimensions large compared with the wave length, and up to the present time the wave lengths required in wireless telegraphy over any considerable distance have been so long as to make reflection practically out of the question. Moreover, even could one conveniently reflect waves many meters in length, it is a question whether the concentrated beam thus formed would be effective at distances so great as to make the curvature of the earth an important element of difficulty. It is possible also to check by absorption waves in undesirable directions, but even so there would be rather waste than saving of energy, and the shielding would be only partial at best. Directive action, like syntonism, may perhaps be attained in time. At present both these desiderata are difficult of attainment. Syntonism depends on securing closely selected wave lengths and using receivers capable of very close tuning. Inasmuch as for long-distance work it seems desirable to use waves as long as the practicable length of antenna permits, the working limits of wave length are too narrow to make syntonic selection within them easy. So far, syntonism is generally claimed and very little applied. If a receiver of extraordinarily great sensitiveness to short waves is devised, it will greatly assist both directive and syntonic working, unless difficulties of wave absorption should develop seriously as the wave lengths are diminished.

THE ELECTRICAL PROPERTIES OF AIR.

Much interesting and valuable information concerning the behavior of air when subjected to electrical stress has been brought forward as a result of relatively recent investigations. It will be recalled that up to within the last few years the resistance of air to rupture under the stress produced by electromotive force was tacitly assumed to be dependent upon the distance apart of the electrodes, and the shape of the terminals. In fact, the striking distance in air between needle points furnishes to-day, perhaps, the most reliable method for determining the maximum value of high electromotive forces for testing purposes. A modifying condition upon which due emphasis has only recently been placed is found in the fact that for a given voltage and a certain shape of terminals the striking distance varies largely with the pressure and temperature of the air. Experimental investigations have shown that the dielectric strength of air is closely proportioned directly to the absolute pressure and inversely to the absolute temperature; that is, it varies directly with the density. The knowledge of this fact has led to the belief that compressed air would serve as an excellent insulator for transformers. The numerous disadvantages attending

the use of air under pressure in a transformer case are well pointed out by Prof. H. J. Ryan in an article which appears in abstract in the Digest for this issue.

An instructive deduction can be obtained from the facts reported by Prof. Ryan. If one assumes a cylinder with insulating walls in which travel two conducting pistons so arranged as to be gas-tight with the side walls, then the electromotive force which can be applied between the two pistons, when there is a certain amount of air in the cylinder, is in all respects independent of the distance separating the pistons. This relation holds true even when the cylinder is subjected to extremes of temperature. It appears that the real dielectric strength resides in the particles of air confined within the cylinder. Since, under otherwise similar conditions, the capacity of a plate condenser varies inversely with the distance separating the plates, it would seem that by using compressed air as an insulator the plates can be brought correspondingly closer together and the capacity thereby increased. As indicated on page 90 of our issue for July 15, Prof. R. A. Fessenden has made use of this fact in the construction of condensers for wireless telegraphy. A valuable property of air under pressure is reported by Prof. Fessenden, who states that above a certain pressure, apparently varying with the structure (but generally above 60 pounds per square inch), all static discharges with accompanying loss of energy, which may amount to 50 per cent in air at ordinary pressures, seem to disappear entirely, and that there is no dielectric hysteresis. No statement is made by Prof. Fessenden as to any variation in the specific inductive capacity of the dielectric with change in pressure of the air, and one is led to assume that the value remains unity under all conditions, as has previously been held. If this latter assumption is correct, then that property of the dielectric which is referred to as the capacity is not a function of the density or arrangement of the particles of the air, but is a function merely of the dimensions of the space between and around the electrodes. That is to say, the evidence at hand would seem to indicate that the so-called specific inductive capacity of air is in reality a property of the ether, while the dielectric strength is a property of the air itself. The evidence on these points is far from conclusive, and further experimentation is desirable. No satisfactory explanation has as yet been offered for the existence of the relatively increased dielectric strength of the surface films of air, nor for the relative decrease in the dielectric strength with abnormal increase in the density of the air, which facts have been ascertained experimentally. At the Asheville meeting of the American Institute of Electrical Engineers, Dr. Steinmetz stated his intention to present later a paper dealing with the dielectric strength of air at various densities and for exceedingly high voltages, and giving a discussion of the source of the strength of air. We look forward with much pleasure to the appearance of this paper, and hope that a similar paper dealing with the specific inductive capacity of gaseous media will soon be forthcoming.

SURGING IN ALTERNATING SYSTEMS.

We cordially advise our readers to make a prayerful study of Dr. Steinmetz's Institute paper on the destructive surges encountered some two years ago on the Manhattan Railway system. The damage done was so serious and the possible damage to successful operation so formidable that nothing short of a complete understanding of the situation could produce any feeling of future security. Fortunately the case came up to Dr. Steinmetz, and he has gone so thoroughly into the theory of the matter as to leave little more to be desired. It is the first time within our knowledge that the theory of a concrete case of formidable surging has been worked out in detail. The general theory of resonance has been more or less often discussed, but generally upon the incorrect assumption that it is to be regarded as occurring upon a circuit in substantially normal condition. Surging, which may be regarded as a special case of impelled resonance, has been studied mainly in its altogether minor effects at switches and the like. We have repeatedly called attention to the primary importance of grounding, and accidental crosses, upon this class of phenomena, and of such action the instance studied by Dr. Steinmetz furnishes emphatic confirmation. Broadly, the accident was the grounding of a large cable in a system of large capacity and enormous output. The result was a tremendous surging of relatively low frequency accompanying the periodic arc from the damaged cable, with dangerous rises of potential that broke down insulation and turned over new parts of the system to destruction.

The most important thing to which Dr. Steinmetz calls attention is the independent existence of three co-operating frequencies in case of trouble on a transmission system. First is the generator frequency providing the impressed e.m.f. This includes, of course, the usual odd harmonics. Second comes the natural period of the circuit, depending on its constants, also with its harmonics, sometimes of considerable amplitude. And third, comes the frequency of the circuit disturbance itself, which depends strictly upon the character of the disturbance and may have a very high value with correspondingly great power to break through insulation. Its importance arises mainly from the fact that it may break the way for dangerous accessions of energy. A very abrupt wave front traveling along a circuit may pile up potential enough to jump long air-gaps and the like, and then the trouble begins. These impulsive e.m.f.'s form what is popularly known as "static," which may also include resonance of higher harmonics and the like. In this Manhattan accident the fundamental frequency of the final surge in the system as a whole was determined to be 270. The instantaneous short-circuit value of the surging current was as great as 9,000 amperes, and the pressure of the oscillation was 68,800 volts per phase, or 119,000 volts between lines, a pressure of itself quite capable of most disastrous effects. A surge like this once started with the whole power of the station behind it was quite certain to wreck things extensively, as it indeed did. It produced a voltage rise to more than ten times the normal value, and had something like 70,000 kw to draw upon for destructive energy.

Phenomena like this are to be sharply distinguished from all ordinary resonance in circuits, for they depend not upon the normal frequency of its harmonics, but upon conditions impressed upon the circuit by casualties. In this instance the trouble started with sparking between a cable conductor and ground, followed by arcing, with the phenomena of surging in its train. Similar occurrences on a much smaller scale are familiar on power transmission circuits, resulting in considerable accessions of potential, the destruction of lightning arresters and other protective devices, and occasionally in injuries to larger apparatus. The larger the capacity of the system, the greater the chance for a surge of low frequency that is not easily damped out of mischief. The lower the resistance, too, the less the surges will be checked, and finally the greater the volume of the surge the higher the e.m.f. of oscillation, so that we are here dealing with conditions which are especially severe in case of very large stations. And it is generally true of such electrical oscillations that systems dealing with currents of large volume at relatively moderate voltage are in greater danger of encountering serious conditions than are high voltage stations in which the volume of current is small and insulation strength is of necessity planned to withstand normally large pressures. It does not take a sensational arc to ground to start mischief from surging—the blowing of a fuse, the sudden opening of a circuit-breaker, the failure of a

lightning arrester, may all induce violent electrical oscillations, the result of which may be disastrous. On overhead systems there is far less likelihood of trouble than on underground ones, fortunately, and the cushioning effect of long lines of relatively large resistance and inductance is very great. But there are many stations in which there is abundant opportunity for trouble, and surging often unrecognized is doubtless the cause of numerous unexplained troubles. Dr. Steinmetz has done an excellent work in putting on record the complete discussion of so striking a case, and we hope that it will lead to a more careful and systematic study of these abnormal oscillations, and to means for their amelioration.

DISCUSSION ON THE ST. LOUIS CONGRESS.

The June number of the *Journal* of the Institution of Electrical Engineers recently issued contains a full record of the discussion in that body of the report by Mr. W. Duddell upon the International Electrical Congress of St. Louis. This discussion had previously been published in this country in abstract only. The views elicited from such prominent physicists as Lord Rayleigh, Profs. Ayrton, Thompson, Glazebrook and others are of great value. They also reveal the great difference in mental attitude of the physicist and the engineer toward a large subject like electrical units and standards, as discussed at St. Louis. The physicist aims to have the standard concrete units as nearly correct as possible, according to their theoretical definition, and leaves the details of the mechanism for issuing reliable working copies of those standards to competent electricians in laboratories. The physicist seeks to know the precise length of a square millimeter mercury wire which shall embody the ohm, considered as one hundred millions of c.g.s. units of resistance in electromagnetic measure. Or he seeks to know as nearly as possible the electrochemical equivalent of silver. Or, again, he seeks to know the precise value of the e.m.f. of a standard cell in absolute electromagnetic units, when the cell has been constructed of chemically pure materials according to definite specifications. But he prefers that the standardization of such knowledge, and its application to the issue of secondary standards by national laboratories should be taken up by other persons. From the physical standpoint this is all eminently correct. The precise values of standard voltages, currents and resistances in absolute measure are of the greatest scientific importance.

On the other hand, the engineer is indifferent to any reasonably small discrepancy in the assigned value of these physical magnitudes. He cares but little whether the e.m.f. of a standard Clark cell at 15° C. is 1.433 or 1.434 international volts. He is almost indifferent whether the electrochemical equivalent of silver is 1.118 milligrams per coulomb, or 1.119. Again, he is not much concerned as to whether the length of a square millimeter mercury column at 0° C., embodying one billion c.g.s. units of resistance, is 106.28 centimeters or 106.29. But he is vitally interested in the uniformity of standards, and he is likely to be much concerned if a certain Clark standard cell at 15° C. is declared to be 1.4328 international volts in Berlin and 1.434 international volts in Washington. He is likely to complain if the electrochemical equivalent of silver is accepted at 1.118 with one kind of coulombmeter in London and with another kind in Paris if the two kinds lead to slightly different values on a certificate of calibration. He is likely to be perplexed if the standard ohms of two different countries differ appreciably. As regards the standard ohm, everyone admits that there is no sensible difference between the values maintained in the principal standard laboratories of the world, and consequently the engineer is content with his ohm. If it should be found that the concrete standard ohm is slightly inaccurate, considered as one billion absohms, the engineer would prefer that the concrete primary standards should not be changed; but that the small correction should be made numerically by physicists when making measurements of high precision. The international ohm should be kept as it is, if possible.

As regards the electrolytically measured ampere, the engineer does not care, for he never makes such electrolytic determinations. That is in his judgment a matter for the physicist. If the standard ampere of the national laboratories is based on electrolytic equivalent, then he asks that the same value shall be used everywhere. The device which the engineer uses, in common with standardized resistance coils, is the standard cell. At present, if he sends that to one national laboratory, he is likely to have its numerical value in volts reported slightly different from that at other national laboratories. This discrepancy actually exists. The engineer does not care which value is right; but he does care if that value differ by an amount which, although small, is capable of producing a commercially appreciable difference in dealing with high-efficiency incandescent lamps. It was to overcome this difficulty and to establish, if possible, complete accord between the working concrete standards of the different countries, that the St. Louis Congress voted in favor of the appointment of an international commission.

It is a matter for some surprise that several speakers in London eulogized the Giorgi system as a solution of the hiatus between the theoretical and practical electrical units. The Giorgi system virtually makes the practical ampere-volt-ohm system into a fundamental system after first modifying the values of the dielectric and magnetic constants of the ether. This displaces the c.g.s. system from use in electromagnetics. Before we can do this, we need new textbooks restating the laws of electromagnetics in the m.k.s.o. (metre-kilogramme-second-ohm) system. This change would have to be made internationally, either by definite promulgation, or by tacit common consent, in order that the change might become effective. If this were done, however, the plan might succeed, and the hiatus between theory and practice in the matter of electrical units would thus disappear. The disadvantages would be that the density of a substance would no longer be equal to its specific gravity in terms of water, and also that electromagnetism would be divorced, as a quantitative branch of science, from other branches, which would continue to work in the c.g.s. system. In other words, unless other branches of science also join in the m.k.s.o. system the hiatus which now exists exclusively in electromagnetics between theory and practice, will be merely shifted from this locality to the boundary between electromagnetism and the rest of the scientific world. For example, the electric resistivity of copper is today expressed in ohm-centimetres among practicians. In electrical theory it is expressed in absohm-centimetres; i. e., in the c.g.s. system. The thermal resistivity of copper is also expressed in the c.g.s. system as a matter within the science of heat. If, however, electricians could all adopt the m.k.s.o. system, the electric resistivity of copper would be measured and expressed in ohm-centimetres, both as a matter of practice and as a matter of theory. But the thermal resistivity would probably go on being expressed in the c.g.s. system. If there were no crossing between the departments of heat and electricity, if there were a permanent barrier between these two branches of science, it would not be a serious matter to have the c.g.s. system in general science, and the m.k.s.o. system in electromagnetism. But all science must be one and the same, fundamentally. Every year makes one branch depend more upon others, and it is against the spirit of the age to make artificial difficulties by incursions or excursions among the different branches. The need for complete uniformity of methods, treatment and measurement is likely to be felt more and more as progress continues.

Electrical Contractors' Convention in Boston.

The National Association of Electrical Contractors held its annual convention in Boston this week, beginning Wednesday, July 19. The convention was accompanied by a large exhibition in Mechanics' Building, where also the sessions were held. As the proceedings are conducted with closed doors and the convention is in session at this writing there is nothing of interest to report as to what was done. The intense heat has interfered with a very large attendance, but there were 173 delegates registered and 263 guests—supply men, exhibitors, etc. The New York contingent arrived on a special train under the conduct of Mr. Alec Henderson, master of transportation, some thirty being on board and a very pleasant trip being made. The dinner of the association was given on Wednesday night, but the attendance was limited to members of the association only. On Thursday the association and registered guests go on a trip to Nantasket Beach by boat and dine at Wade's Nantasket Point Hotel.

Elsewhere a very full and complete illustrated account is given of the exhibit, with the names of the participants and their representatives.

The Electrical Engineer in Heavy Electric Traction.

The July issue of the Proceedings of The Engineers' Club, of Philadelphia, contains an interesting paper by Mr. William McClellan, on the subject indicated by the title above, which discusses the engineering features involved in the substitution of electricity for steam on railroads. The author calls attention to the fundamental difference between steam and electric systems, with reference to power conditions. The steam unit is well contained and independent of the other units. In the electric system, however, the power which must be available at each point depends upon the maximum units which may be massed at that locality. This condition dictates that before construction begins, the required capacity of the road, its train service, etc., must be more or less accurately determined. With steam traction, it is possible to transfer locomotives in any number desired to points where the traffic becomes congested. In this respect the steam road has a flexibility not possessed by the electric system. To this fact may be attributed the conservatism that has prevailed in advising a change. In the selection of the electric equipment for a given road careful consideration must be made of the question of motor temperature. This is a feature that is entirely absent from steam railroad practice. If the locomotive will give the required tractive effort at the required speed, it will do the work. If it is overloaded, even to being stalled, no harm is done. Not so with the car motors. Continued overloads, or even what is called normal load, if the gear-ratio be improperly chosen, will cause the temperature in the coils to rise to a point at which the insulation chars.

The paper contains descriptions of the dynamometer cars of the Pennsylvania and Illinois Central railroads and of the air-resistance car used by the Louisiana Purchase Test Commission. Only by means of such cars can there be obtained reliable data upon which to base calculations for the electric equipment required for a given service. The author discusses the various factors which enter into the determination of the power required, under the heads of grades, curves, braking, mechanical friction, wind resistance, translational and relational inertia. There are available innumerable formulas for expressing the value of the train resistance. Each formula is subject to the criticism that it has been derived from special conditions of some sort, and it will not answer for general work. Our definite knowledge seems to be that with properly shaped cars, the train resistance for single cars up to nearly 100 miles per hour will not greatly exceed 30 pounds per ton, and that a comprehensive formula, when found, will be of the form:

$$R = A + B\,V + C\,V^2$$

where A is a factor depending chiefly on journal conditions, B is a factor depending chiefly on rail conditions, and C is a function of train weight and formation.

The striking point in connection with the discussion of this whole problem is the great lack of data. With increase of acceleration, especially with frequent stops, many features of train problems become relatively more important. The limit to acceleration is the comfort of the passenger. A passenger does not complain much of a little jolting at the beginning and end of an hour's run, but the occurrence of the same thing every five minutes is likely to be resented. The criticism has been made that steam roads and locomotive builders never did have, and have not yet the facilities for the same kind of elaborate experimental work that has been done by the great electrical companies. This is probably true, but they had not previously needed the information in the same way that it is now needed. The fact is that no real progress will be made until adequate data have been collected. The cry is now going up for data in central station work, in lighting, everywhere, but nowhere is the need greater than in electric railway work.

Feed Water, Heaters and Pumps.

The request, "Please give a formula for boiler compound for water in which there is a heavy lime deposit," in the "Question Box" of the N. E. L. A., received three responses. Two of these advocate the use of washing soda in conjunction with kerosene oil, the proportion being a bucketful of soda to two gallons of oil for a 100-hp boiler. The third suggests 40 pounds caustic soda, 40 pounds soda ash, 35 pounds liquid hemlock, 15 pounds gambier dissolved in hot water to make one barrel of dissolvent. Of the thirteen replies received to the query, "Which is preferable—to treat the water before it enters the boilers, or to use a high-fire kerosene and mechanical cleaner?" twelve indicate that the former method is preferable, while one recommends that, if the plant is large enough to warrant the expense of a chemical purifier, one should be installed. The replies to the question, "Does not kerosene oil, being itself a condensation from a still, vaporize before any benefit is derived when fed into working boilers to prevent scale?" are seemingly contradictory. The consensus of opinion, however, is that while the use of oil is attended with fair success other and better methods can be found. Ten replies to a question concerning the location of the heaviest deposit of magnesia within a boiler, are common in that all agree that the greatest precipitation is produced at the point of highest temperature. Of the three remedies proposed for keeping feed water pipes clear of scale where the water is exceptionally full of magnesia carbonate, two involve the treatment of the feed water, while the third would allow the scale to form and remove it from time to time.

The answers to a question concerning the advisability of using a heater between the engine and the condenser would leave one in great doubt as to the proper plan to adopt, there being nine positive, five negative and four neutral replies. To the query, "Is it good practice to turn exhaust from station auxiliaries into an open-type, feed-water heater?" the 12 replies would indicate that an open-type heater accumulates the oil, thus making poor water to feed to the boilers and, therefore, if the practice is followed, an oil separator should be used. The advantages of the open type of heater for large plates are stated to be that it returns the condensation to the boiler, thus saving water and lessening the deposit of scale, and it is easy to keep clean, thus insuring good efficiency, while the advantage of the closed type of heater is that it avoids the possibility of oil being carried into the boilers. Two replies to the query, "What is the life of a hot water meter when run continuously in full capacity?" indicate that the meter develops an error of five per cent within ten days, and that the life is about eight months. Although two of the replies to a question concerning the benefit of an air chamber on a boiler feed pump express doubt as to any benefit, the others agree that the air acts as a cushion for the surging water due to the action of the pump, and prevents a water hammer in the feed pipes. In regard to the method of driving auxiliaries a correspondent states that "in a non-condensing plant the motor-driven boiler feed pump is doubtless the most economical form that can be employed. Centrifugal feed pumps have hardly had sufficient use to demonstrate their reliability. If motor-driven pumps are used one steam-driven pump or injector should be installed for use when the generators are all shut down. In turbine plants steam-driven auxiliaries will be the more economical up to the point where all the exhaust steam can be condensed in heating the feed water. Beyond that point motor-driven auxiliaries should be used." The eleven replies to the query "We have a heater, purifier and feed pump which delivers the water to the boilers at 206° F. Is this fairly economical?" agree that the performance is very good.

An Engineering Congress at the Portland Exposition.

Pacific Coast and Northwest electrical development has received a marked impetus from a congress of Pacific Coast electrical and mechanical engineers just held in Portland. It is the first meeting of this kind, and will probably be followed by other congresses on occasions of inter-state importance like the Lewis and Clark Fair. The first congress was originated by Milnor Roberts, professor of civil engineering in the University of Washington. The participants were members of the Pacific Northwest Society of Engineers, Seattle; the Technical Society of the Pacific Coast, San Francisco; the Pacific Coast Electrical Transmission Association; the Montana Society of Engineers; the Washington Chapter of the American Institute of Electrical Engineers; delegates numbering in all over 200. There were large delegations from Seattle, Spokane, Tacoma, Los Angeles and San Francisco. Oregon has a rapidly growing colony of electrical engineers, and all were active in assisting to make the first Portland congress a success. Geo. Perley Low, of San Francisco, who is a Portland man, and was elected president of the Pacific Coast Electrical Transmission Association at this meeting, came from California with an excursion party of delegates that filled three Pullman cars.

The convention was called to order at 10 o'clock a.m., Thursday, June 29, by H. W. Goode, president of the Lewis and Clark Exposition, who is also president of the Portland General Electric. For permanent chairman the congress elected Geo. W. Dickie, of San Francisco, president of the Technical Society of the Pacific Coast; and Prof. M. Roberts for secretary. The business affairs of the congress were placed in charge of an executive committee composed of Messrs. Low and Roberts, and Franklin Riffle, of San Francisco.

The congress met in two sections, a general congress section and an electrical transmission section, and meetings were held in the parlors of the American Inn, in the exposition grounds. There were addresses of welcome by Mr. Goode, Geo. P. Low, Frank W. Hibbs, president of the Northwest Society of Engineers, and Geo. W. Dickie. Before the joint session Thursday morning papers were read as follows: "The System of the Portland General Electric Company," by F. G. Sykes, general superintendent; "Water Power as a Factor in Industrial Development," by Charles H. Baker, member Pacific Northwest Society of Engineers.

The electrical transmission session, Thursday afternoon, listened to the following papers: "The Engineering Features of the Exposition," by J. R. Thompson, electrical engineer Lewis and Clark Exposition; "Engineering and Commercial Features of the Lewiston-Clarkston System," by Allen E. Ransom, electrical engineer of the Lewiston-Clarkston Company, Clarkston, Wash.; "Expositions as Engineering Educators," by G. H. Patten, of the General Electric Company, Portland headquarters; "Single-Phase Railways," by M. P. Randolph, of the Westinghouse Electric & Manufacturing Company, Seattle.

On Friday the electrical transmission section heard papers on these topics: "The Value of Sawdust as Fuel," by O. B. Caldwell, operating Superintendent Portland General Electric; "On the Cost of Irrigation by Electrically Driven Pumps, from Transmission Service," by W. W. Wheeler, superintendent of the Northern California Power Company, Redding, Cal.; "The Cedar River Plant of the City of Seattle," by J. D. Ross, assistant engineer, Seattle; "Report of Progress Editor," by F. A. C. Perrine, New York; "Wrinkles," by R. W. Van Norden, superintendent Central California Electric Company, Sacramento; "The Question Box," by C. A. Copeland, consulting electrical and mechanical engineer, Los Angeles, Cal. The association elected the following officers for the ensuing year: President, Geo. P. Low, editor Journal of Electricity, Power and Gas, San Francisco; vice-president, H. H. Sinclair, of the Edison Electric Co., Los Angeles; secretary, S. G. Reed, treasurer Portland General Electric Company.

On Saturday the congress went on an excursion to The Dalles of the Columbia River, accompanied by Portland engineers and officers of the U. S. engineering corps in charge of river improvements. Sunday the delegates attended a steamer excursion on the Willamette River to the falls at Oregon City, to inspect the hydro-electric plants of the Portland General Electric. Monday they went in a special train furnished by the Oregon Water Power & Railway Company to Cazadero, to examine the dam on the Clackamas River under construction by that company. The Californians in attendance at the congress went to Seattle, Tacoma, Snoqualmie and Electron, Washington, to look at power and lighting plants. At Snoqualmie they were unfavorably received, the general superintendent of the company refusing them admission to the plant. They were compensated for the trip to Washington by the reception given them by H. F. Grant, manager of the Seattle Electric Company. He took them over the lines about Seattle, and over the interurban to Tacoma, in a special palace car, and entertained them with luncheon at the Rainier Club. The tourists were eloquent in praise of Mr. Grant's hospitality.

Indiana Telephone Associations Merge.

An important meeting of telephone men representing the independent telephone interests of Indiana was held July 12 at Winona, at which was formed the "Indiana Independent Telephone Association." It is the purpose to merge the Indiana Mutual Telephone Association and the Southern Indiana Telephone Association into the new association. About seventy-five telephone men attended the meeting, which was called to order by Theadore Thorward, president of the Indiana Mutual Telephone Association, to devise ways and means to best protect the independent properties against the new plan of attack by the Bell Company. He said the necessity was present for a closer organization; that the organizations they now have are nothing more than social gatherings with nothing in them but good fellowship and a good time. He suggested a plan for a close district organization all over the state that would combine all the independent companies in the districts with iron-bound contracts calculated to protect large and small companies against the common enemy as well as against each other. He also suggested the formation of a strong financial state institution to look after small or struggling companies to avoid their falling into the hands of the Bell company.

A committee on organization reported back to the meeting a preamble, constitution and by-laws for the new organization, which were adopted. The plan includes the formation of district associations, which are to be represented in state meetings by delegates. Each district president will be a vice-president in the state organization. The organization was perfected by electing George W. Beers, of Fort Wayne, president, and C. S. Norton, of Indianapolis, secretary-treasurer, and the following district vice-presidents: First district, Theadore Thorward, South Bend; second district, W. L. Moellering, Fort Wayne; third district, W. J. Uhle, Logansport; fourth district, O. P. Frerbing, Lafayette; fifth district, Thos. A. Bromley, Jr., Muncie; sixth district, Charles R. Duffin, Terre Haute; seventh district, W. W. Mendenhall, Indianapolis; eighth district, A. C. Lindermuth, Richmond; ninth district, W. C. Curil, Petersburg; tenth district, C. D. Knoefel, New Albany; eleventh district, W. R. Swarthout, Rising Sun. Following the organization a warm discussion was had concerning the eligibility to membership of companies that have entered into toll line arrangement with the Bell Company. It was generally insisted that such companies should not be admitted, but the matter was deferred until the next meeting.

President J. B. Hoge, of the National Independent Association, was present and rendered material assistance in organizing the new association. Mr. Hoge said he was gratified over the movement in Indiana, for it meant that the fighters of the telephone "trust" were thus brought into a more compact body in this State, but let the Indiana men join hands with the independent associations of Ohio, Michigan and Wisconsin and other States, as well as get into closer relation with the National Association.

Mr. Charles S. Norton said there was no cause for alarm; that independent telephony was never so prosperous as at present. He said independent companies were in favor everywhere, and that only two or three had passed to the control of the Bell Company. The total of Indiana independent telephones is 166,255, and 100,333 of them have connection with independent toll lines.

Other speakers said that their business is growing faster than they could provide for it. They also commended the new association and said its aggressive membership would be the means of still greater expansion of the independent telephone business in Indiana. At the close of the meeting the delegates became the guests of Walter Scott, superintendent of the Warsaw Commercial Telephone Company, in a boat ride around the lake.

Tesla on the Peary North Pole Expedition.

The New York *Sun* of July 16 prints the following letter from Mr. Nikola Tesla:

Everybody must have been pleased to learn that Commodore Peary has finally obtained the financial assistance which will enable him to start without further delay on his important journey. Let us wish the bold navigator the most complete success in his perilous undertaking, in the interest of humanity as well as for his own and his companions' sake and the gratification of the generous donors who have aided him. But, while voicing these sentiments, let us hope that Peary's will be the last attempt to reach the pole in this slow, penible and hazardous way.

We have already sufficiently advanced in the knowledge of electricity and its applications to avail ourselves of better means of transportation, enabling us to reach and to explore without difficulty and in a more perfect manner not only the North, but also the South Pole, and any other still unknown regions of the earth's surface. I refer to the facilities afforded in this respect by the transmission of electrical energy without wires and aerial navigation, which has found in this novel art its ideal solution.

Many of your readers will, no doubt, be under the impression that I am speaking merely of possibilities. As a matter of fact, from the principles involved and the experiments which I have actually performed, not only is the practical success of such distribution of power reduced to a degree of mathematical certitude, but the transmission can be effected with an economy much greater than possible by the present method involving the use of wires.

It would not take long to build a plant for purposes of aerial navigation and geographical research, nor would it cost as much as might be supposed. Its location would be perfectly immaterial. It might be at the Niagara, or at the Victorian Falls in Africa, without any appreciable difference in the power collected in a flying machine or other apparatus.

A popular error, which I have often opportunity to correct, is to believe that the energy of such a plant would dissipate itself in all directions. This is not so, as I have pointed out in my technical publications. Electricity is displaced by the transmitter in all directions, equally through the earth and the air; that is true, but energy is expended only at the place where it is collected and used to perform some work. To illustrate, a plant of 10,000 hp, such as I have been planning, might be running full blast at Niagara, and there might be but one flying machine, of, say, 50 hp operating in some distant place, the location being of absolutely no consequence. In this case 50 hp would be all the power furnished by the plant to the rest of the universe. Although the electrical oscillations would manifest themselves all over the earth, at the surface as well as high in the air, virtually no power would be consumed. My experiments have shown that the entire electrical movement which keeps the whole globe a-tremble can be maintained with but a few horsepower. Apart from the transmitting and receiving apparatus, the only loss incurred is the energy radiated in the form of Hertzian or electro-magnetic waves, which can be reduced to an entirely insignificant quantity.

I appreciate the difficulty which your non-technical readers must experience in comprehending the working of this system. To gain a rough idea, let them imagine the transmitter and the earth to be two elastic bags, one very small and the other immense, both being connected by a tube and filled with some incompressible fluid. A pump is provided for forcing the fluid from one into the other, alternately and in rapid succession. Now, to produce a great movement of the fluid in a bag of such enormous size as the earth would require a pump so large that it would be a greater task to construct it than to build a thousand Egyptian pyramids. But there is a way of accomplishing this with a pump of very small dimensions. The bag connected to the earth is elastic, and when suddenly struck vibrates at a certain rate. The first artifice consists in so designing and adjusting the parts that the natural vibrations of the bag are in synchronism with the strokes of the pump. Under such conditions the bag is set into violent vibrations, and the fluid is made to rush in and out with terrific force. But the immense bag—the earth, is still comparatively undisturbed. Its size, however, does not exempt it from the laws of nature, and just as the small bag, so too the earth, responds to certain impulses. This fact I discovered in 1899.

The second artifice is to so adjust the transmitter that it will furnish these particular impulses. When all is properly done the large bag is thrown into spasms of vibration, and the effects are bewildering. But no power is yet transmitted, and all this colossal movement requires little energy to maintain. It is like an engine running without load.

Next let your readers imagine that at any place where it may be desired to deliver energy a small elastic bag, not unlike the first, is connected to the large one through a tube. The third artifice consists in so proportioning the parts that the attachment will be responsive to the impulses transmitted, this resulting in a great intensification of the vibration of the bag. Still the pump will not furnish power until these vibrations are made to do work of some kind.

To conduce to an understanding of the fourth artifice, that of "individualization," let your readers follow me a step further, and conceive that the flow of energy to any point can be controlled from the place where the pump is located at will, and with equal facility and precision, regardless of distance, and, furthermore, through a device such as the combination lock of a safe, they will then have a crude idea of the processes involved. But only when they realize that all these and many other processes not mentioned, and related to one another like the links of a chain, are completed in a fraction of a second, will your readers be able to appreciate the magical potencies of electrical vibrations and form a conception of the miracles which a skilled electrician can perform by the use of these appliances.

I earnestly hope that in the near future the conditions will be favorable for the construction of a plant such as I have proposed. As soon as this is done it will be possible to adapt electrical motors to flying machines of the type popularized by Santos Dumont. There will be no necessity of carrying a generator or store of motive energy and consequently the machine will be much lighter and smaller. Owing to this and also to the greater power available for propulsion, the speed will be considerably increased. But a few of such machines, properly equipped with photographic and other appliances, will be sufficient to give us in a short time an exact knowledge of the entire earth's surface. It should be borne in mind, however, that for the ordinary uses of a single person a very small machine of not more than one-quarter horse-power, corresponding to the work of two men, would be amply sufficient so that when the first plant of 10,000 hp is installed, the commodity of aerial flight can be offered to a great many individuals all the world over. I can conceive of no improvement which would be more efficient in the furtherance of civilization than this.

Dealing with Travel Problems in London.

Dispatches from England state that the royal commission appointed in February, 1903, to inquire into the means of locomotion and transport in London has issued its report. It declares that everybody knows that the existing means are seriously defective. It adds that improvement is imperatively necessary in the interests of public health and convenience, for the prompt transaction of business, and to render decent housing possible.

The narrowness of the streets lies at the root of the problem of surface locomotion. The commissioners recommend the widening of many important thoroughfares, and what is one of the most striking points of their whole report is the construction of two great avenues, one running east and west, four and three-quarters miles long, and the other running north and south, four and a quarter miles long. Each avenue would be 140 feet wide, with four tramway tracks on the surface and four electric railway tracks underground. The commissioners apparently regard this somewhat as the counsel of perfection, at any rate for the present, for the estimated cost is from £25,000,000 to £30,000,000. Nevertheless, they strongly urge this plan if it is found to be financially practicable.

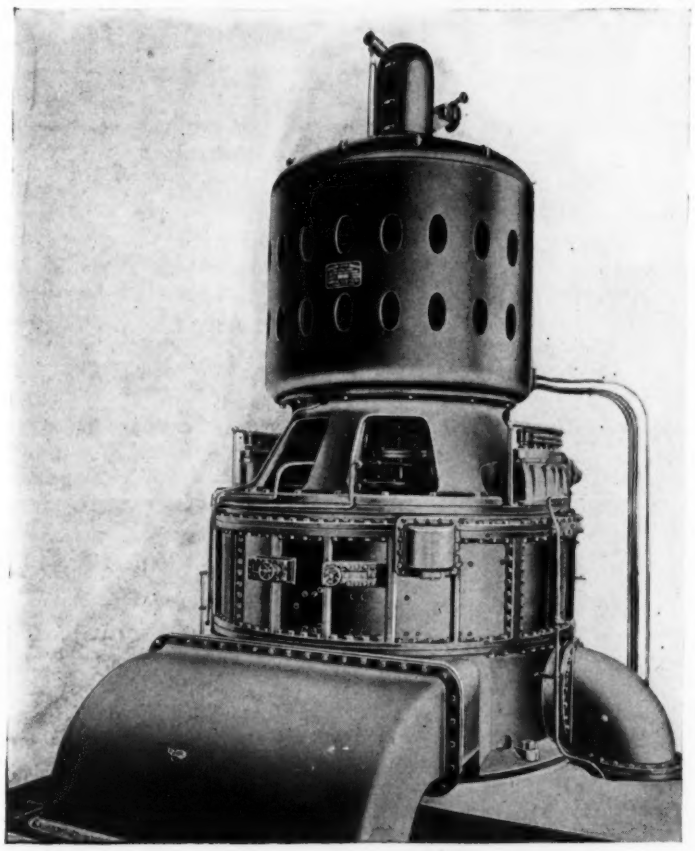
In dealing with tramways the report remarks that the existing tramway mileage is quite insufficient and is conspicuously inferior to that of American, European and provincial English cities. It recommends a large extension and the linking of various systems. More railways also are needed, and they should be, if necessary, aided by the local authorities. Shallow subways are regarded as preferable to deep laid tubes, although the former in some cases are admitted to be impracticable. The opinion is expressed that motor omnibuses will never take the place of tramways.

The construction of the two avenues and the carrying out of the commission's other recommendations would be enormously expen-

sive. The commissioners recognize that this will prevent the adoption of an ideal scheme, but in view of the apparent fact that the metropolitan population will reach 11,000,000 in the near future they declare that the utmost possible ought to be done, and they urge the creation of a permanent body to deal with the question.

Steam Consumption of Curtis Turbines.

The accompanying table gives results of tests made by Mr. Frederick Sargent and Mr. Louis A. Ferguson on a 2,000-kw steam turbine generating unit of the Curtis type. The turbine is a four-stage machine designed in 1903, and recently changed in a few particulars as a result of experiments conducted during the past year. The machine as tested conforms as nearly as possible to the standard four-stage machines now being produced, but is less efficient because the changes which have been made have been confined to the buckets,



TURBO-GENERATOR.

while several other important changes, which are now known to be desirable, could not be made in this case without entirely rebuilding the machine.

TESTS OF CURTIS TURBO-GENERATOR.

Load, ratio to full value	4/4	3/4	1/4	0/4
Duration of tests, hours	1.250	0.916	1.000	1.33
Steam pressure (gauge), lbs	163.3	170.2	155.5	154.5
Back pressure (absolute) in. of hg	1.49	1.40	1.45	1.85
Superheat, deg. F.	207.	120.	204.	156.
Load in kilowatts	2023.7	1066.7	555.	00.
Steam consumption per kw.-hour	15.02	16.31	18.09	1510.5*

*Total pounds of steam per hour.

All of the instruments were carefully tested and standardized during the trials, the electrical instruments being checked at the New York Testing Laboratory. The surface condenser showed practically no leakage. Every precaution was taken to make the tests reliable and accurate.

Western Union and Racing Service.

After a meeting last week of the executive committee of the Western Union Telegraph Co. the following statement was issued:

Whereas, this company under an order issued by its president on the 18th day of May, 1904, has directed the cessation of the collection of horse-race reports; and, whereas, it is claimed that the distribution of horse-race reports still continues notwithstanding the action of this company first referred to,

Be is resolved, that it be recommended to the board of directors that the officers of the Western Union Telegraph Company be directed to cease the transmission of any messages containing horse-race reports, except where such messages are delivered to a regular office of the company for transmission to and delivery through a regular office of the company, or for delivery in such other manner as the president of the company shall authorize over his signature.

A Westinghouse Denial.

Mr. George Westinghouse issued last week the following denial of a statement that the Westinghouse interests were going extensively into the operation of trolley lines in competition with some of the large railroad systems:

"Mr. Westinghouse's attention having been called to an article in one of the morning papers, he said that he deemed it important to at once deny the statement that there was any Westinghouse scheme to go into the business of building electric railways parallel to or in opposition to steam railways, which statement he characterized as an attempt of unfriendly interests to prejudice the managers of railways against the Westinghouse interests. As to the other statements in the article in question, Mr. Westinghouse sees no occasion to comment on them."

The "other statements" had it that John F. Wallace, who recently resigned as Chief Engineer of the Panama Canal to accept a "$65,000 offer" from somebody whose identity is still undisclosed, was going to be identified hereafter with the Westinghouse interests. Mr. Westinghouse, when pressed for an answer on this point, would make no comment. A friend of his said, however: "Mr. Wallace has been named for almost everything, and it isn't strange that they are coupling him up with Mr. Westinghouse now. Mr. Westinghouse could deny it, but he won't. He prefers not to say anything on the subject."

Calcium Carbide in France.

Mr. Robert T. Skinner, U. S. Consul General at Marseilles, makes an interesting report to the Department of Commerce and Labor on calcium carbide and acetylene in France. He says: "The principal centers of the calcium carbide industry in France are in the Alps and the Pyrenees, particularly in the environs of Bellgarde, Grenoble, Nice and Toulouse. At present there are 11 manufactories capable of producing 40,000 tons of calcium carbide annually. The demand is far from corresponding to the means of production, and the total output sold during 1904 may be closely estimated at 18,000 tons.

"The average yield of gas per unit of weight of carbide is 300 liters (79.25 gallons) per kilogram (2.2 pounds). There appears to be no market rate, properly speaking. The French manufacturers are completely protected against importations by the Bullier patent, and manufacturers of carbide and acetylene have reached an understanding whereby an average price has been established which enables both industries to exist. The manufacturers of carbide are said to lower their prices every time they are able to do so without inconveniencing themselves.

"The merchandise is packed, according to the wish of the buyer, in metallic cans of 100, 65 or 50 kilos (220, 143, or 110 pounds) capacity, or, in case of shipment for exportation, in wooden cases lined with tin. Sales are controlled by the Société Commerciale du Carbure de Calcium, with headquarters at 2 rue Blanche, Place de la Trinité, Paris. This company has a capital of 2,200,000 francs ($424,600) and has been chosen by the eleven producing concerns as the selling agent for the entire country.

"The cost price of a ton of calcium carbide in Europe was estimated by Professor Lefevre, professor at the School of Sciences at Nantes, in 1897, at from 200 to 250 francs ($38.60 to $48.25). There was nothing then, so he stated, to indicate the probability of these figures being sensibly modified. M. Pictet, however, in the same year thought that the product might be made at a price of 82 francs ($15.82) by the use of a new furnace.

"It is said, however, that in 1904 the production was disposed of at $38.60 per ton."

CURRENT NEWS AND NOTES.

MILAN EDISON COMPANY'S LOST BONDS.—According to a Milan, Italy, dispatch dated July 13, the Edison Company has discovered that bonds have been stolen from it to the value of $240,000. A former clerk is under arrest, charged with the robbery.

COLORADO CONVENTION.—The annual convention of the Colorado Electric Light, Power & Railway Association will be held at Glenwood Springs, Col., September 18, 19 and 20. Mr. George B. Tripp, of Colorado Springs, is secretary, and expects a large gathering. Action may be taken to include States surrounding Colorado.

MORE NEWFOUNDLAND CABLE.—The Commercial Cable Company has agreed to lay 200 miles of deep sea cable for the colonial government, to connect the island with Canso, Nova Scotia, where the Commercial Cable Company's cables and land lines will afford communication with the rest of the world. The new cable is to be laid by September.

UNIDIRECTION WIRELESS.—A special cable dispatch from Berlin, Germany, of July 12 says: "An important improvement in wireless telegraphy is announced by Prof. Braun, of Strassburg, the inventor of the system which bears his name. The professor has succeeded in sending wireless electrical waves in a single direction. Up to now it has been possible only to transmit waves in all directions. Much energy is saved by the new invention." We make editorial reference to this dispatch on page 126.

ELECTRIFYING LAKE SHORE.—A special dispatch from Toledo, Ohio, of July 17, says: "Officials of the Lake Shore & Michigan Southern Railway say that the visit of W. K. Vanderbilt to this city recently was in regard to the advisability of installing an electric service on the Detroit & Toledo division of the line. It is said that Mr. Vanderbilt has decided the plan is feasible and that it will be put in operation at once. The initial steps in this plan will be confined to the freight business at first. It is impossible for the steam roads to compete with the electrics on short hauls in this region owing to the cheapness of electricity for motive power."

LIGHTING AT COLUMBUS, O.—The report of the sub-committee of the committee which is investigating the municipal electric light plant cost of operation shows that the lamps of the municipal plant have cost the city $98 a year. The city pays $74.50 for lamps lit by private lighting companies. The report covers a period of four and a half years, and the plant is branded as a "monstrous extravagance." In the time covering the report the committee shows that the total cost of maintenance was $75,360.52, interest on bonds $18,171.13, and the estimated depreciation is placed at $40,000, making a total expenditure of $133,531.65. At this price it cost the city $98.91 a year for the maintenance of each lamp. The report does not cover the new system in operation, but an investigation of this also is expected to follow.

WAGES FOR BEGINNERS.—The General Electric Company, which is looking for apprentices at its West Lynn factory, in response to inquiry, announces the following salaries: To graduates of high schools only—drawing office apprenticeship course, $5.33 per week for first six months, $6.30 per week for second six months, $7.28 per week for third six months, $8.25 per week for fourth six months, $9.22 per week for fifth six months, $10.67 per week for sixth six months. There will also be a bonus of $75 distributed if the three years of service have been satisfactory. Shop apprenticeship course, $4.48 per week for first six months, $5.60 per week for second six months, $5.72 per week for second year, $7.84 per week for third year, $9.24 per week for fourth year; bonus of $100 at expiration of term if services have been satisfactory. For high school students and grammar school graduates—shop apprenticeship course—$3.36 per week for first six months, $4.48 per week for second six months, $5.60 per week for second year, $7.00 per week for third year, $8.40 per week for fourth year; bonus of $100 at expiration of term if services are satisfactory.

THE CHICAGO TUNNEL.—Messrs. E. C. Shankland, John M. Ewen and Louis Ritter are the three engineers who have been appointed by Commissioner of Public Works Patterson, of Chicago, to investigate the Illinois Tunnel Company's undermining of the city's streets and to determine the danger to the downtown structures and the sinking of the streets reported to be due to the tunnel company's bores. The engineering commission will begin its work at once. The expense of the investigation is to be borne by the corporation under the provisions of the ordinance which requires that the company shall pay for all examinations of its work.

SIERRAS POWER PLANT.—A statement has been published that the Southern Pacific Company has an engineering force at work investigating sites along the Truckee River, between Truckee and Verdi, for the purpose of installing a monster electric power plant. The plant, it was said, would furnish power for boring a five-mile tunnel through the Sierra Nevada Mountains. General Manager Calvin says: "Nothing is being done on the tunnel project at present, and the company is not looking for any site for the power plant on the Truckee River or elsewhere. I understand that other interests are at work on a power project up there, planning to supply electrical power to some of the big Nevada mines. The Southern Pacific has no interest in it whatever."

LONG ISLAND ELECTRIC TRAINS.—The first electric train on the Long Island Railroad was run on July 18 from Woodhaven Junction to Flatbush and back. Two round trips were made for the purpose of testing the clearances of the contact shoes on the third rail. This is the first practical test of the new electric equipment, on which the road is spending $40,000,000. This week also a train of five cars will make a trial trip to Rockaway Beach, and it is expected that by the first of next week electricity will take the place of steam on the whole Rockaway Beach division. General Superintendent C. L. Addison and Electrical Superintendent L. S. Wells were in charge of the trial run, which was considered a very satisfactory one. A speed of thirty-five to forty miles an hour was maintained without difficulty on the elevated portions of the track.

TELEPHONY IN CANADA.—The Canadian Parliamentary Telephone Committee last week heard the evidence of A. L. Tetu, Nashville, Tenn., secretary of the National and the Interstate Telephone Associations. He testified as to the competition between the independent and Bell systems. He did not think the time had come for government ownership of telephones and telegraphs, but did think the government should impose restrictions in franchises forbidding competing companies to sell out to one another. A local system with antiquated equipment should bring its apparatus up-to-date before being admitted to a long-distance service. He knew of any number of cases where farmers enjoyed telephone service at $15 a year. In a city of 20,000 a fair rate would be $30 for business and $18 for residence. Mr. Ware also testified as to independent conditions in Michigan. He believed in government ownership of long-distance lines, but not of local exchanges.

PREVENTION OF SPARKING IN DIRECT-CURRENT MACHINES.—Having observed that in order to neutralize the demagnetizing effect of the armature current upon the field it is necessary to place the brushes on one side of the neutral point, while for non-sparking conditions it is necessary to place the brushes on the opposite side of the neutral point, D. Balachowsky and P. Caire have devised a scheme involving the use of brushes in both positions, for which a patent was granted on July 11. Thus, for a two-pole armature there would be four brushes, two positive and two negative. One positive brush is placed ahead of the positive neutral point, while the other is placed behind the positive neutral point, these two brushes being joined directly together. A similar disposal is made of the two negative brushes. The positions of the brushes are so chosen that the e.m.f. in the coils in front of the neutral line is greater than that of the coils behind. The magnetizing action of the current which flows in the local brush circuit due to the difference of these e.m.f's is in a direction simultaneously to strengthen the field magnetism and to assist in the prevention of sparking. The inventors state that it is possible thus to render the machine compound or overcompound, or even to obtain a machine operating without windings on the field magnets.

FREIGHT IN CHICAGO.—The Chicago City Council has granted to the Metropolitan Elevated electric road the right to carry freight and express, for ten years.

AUTOMOBILE SHOW IN MILAN.—An interesting show, largely made up of national exhibits of automobiles, cycles, etc., is being held in Milan, Italy. There are three exhibits of American cars.

A CITY ELECTRICIAN.—The office of city electrician has been created for Bath, Me. This functionary is to have very full powers over all electrical work done in the vicinity, under the guidance of a joint committee on electrical appliances, consisting of the mayor, president of council, two aldermen and three members of the common council.

DR. GISBERT KAPP has accepted a professorship in electrical engineering at the University of Birmingham and has resigned as general secretary of the German Association of Electrical Engineers and as editor of the *Elektrotechnische Zeitschrift.* His successor as general secretary is chief engineer Georg Dettmar, and his successor as editor of the *Elektrotechnische Zeitschrift* is Mr. E. C. Zehme.

LONG DISTANCE TRANSMITTER.—A Sioux City dispatch says: M. L. Marrett and E. W. Preston, two Sioux City electricians, after years of work, have applied for a patent upon a telephone transmitter that will enable persons to talk 3,000 miles without the necessity of having messages repeated every 500 to 600 miles. Two electric magnets are placed quite close to the disc of the ordinary telephone and this magnifies the sound, and extra wire around the induction coils beside the magnets does away with sputtering. In several trials the voice was heard perfectly over a resistance equal to 3,000 miles of wire.

INSTEAD OF THE BARBER.—Advices from Paterson, N. J., state that telephones on barber chairs are the latest innovation there and so popular is the plan that before long it is expected other barbers in the city will have telephones installed. The barber shop in the Romaine Building is the only one, it is believed, in the United States which can boast of having telephones on its chairs. Through them it is possible for a business man, while being shaved, to hold constant communication with his office. The barber in charge says that he put in the telephones as an experiment, and he has been congratulated by several of his customers, who are unanimous in their opinion that, while the plan is a novel one, it is soon to become popular in other places.

ELECTRICAL EXHIBITION AT KIEV, RUSSIA.—United States Consul Thomas E. Heenan, Odessa, Russia, reports that an electrotechnical exhibition will be held at Kiev in 1906. The ministry of finance will permit the importation of the latest appliances and inventions in the realm of electrotechnical science for purposes of exhibit under the following rules: (1) The exhibition committee must deposit security to the amount of customs duty according to the tariff, which will be returned when the goods are re-exported, which must take place not later than three months after the closing of the exhibition; (2) the goods are to be exported by way of the same custom houses through which they entered Russia. It is probable that this exhibition will take place at Easter, 1906.

VOLTAGE REGULATOR.—A simple form of regulator for governing the field strength of generators is disclosed in a patent granted July 11 to Mr. P. M. Lincoln. In series with the field coil of the generator is connected a resistance which is periodically short-circuited. The novel features of the present patent reside in the means employed for varying the relative time when the resistance is in circuit and when it is shunted. There is provided a continuously rotating cylinder formed in two segments connected separately to the ends of the resistance, and separated by insulation, the form of which is such that an arm makes contact with one or the other segment throughout a definite proportion of each revolution of the cylinder according to the position of the arm. The arm is governed in position by an electromagnet whose strength depends upon the voltage of the generator. By means of this device the time-average amount of resistance in series with the field magnet winding of the generator may be maintained such as to insure a substantially constant voltage on the line.

OPERATING WITHOUT GOVERNORS.—The entire great network of transmission lines in the vicinity of Salt Lake City, operated by the Utah Light, Power & Railway Company, in parallel with the Telluride Power Transmission Company, is now being operated without governors on the water wheels. This is made possible by the great fly-wheel effect of the armatures of the generators, motors and rotary converters connected with the system and the great size of the system. Fluctuations of load at any one point are so small compared with the total load of the system and the combined fly-wheel effect is so large that governors have apparently been rendered unnecessary.

STUDYING FOREIGN CONDITIONS.—Chairman Barker, of the Massachusetts Gas and Electric Commission; Commissioner George and Special Commissioner Cotter will sail from Boston for England August 1 for the purpose of investigating the sliding scale of gas prices as operated in London with a view to having the same introduced in the Boston gas field. The three commissioners will be abroad about five weeks and will also undoubtedly visit the municipal plant at Glasgow as well as those at Sheffield, Liverpool and other cities. The special commission must report its findings to next year's legislature. Expenses of the trip amounting to $1,800 have been approved by Governor Douglas and his council.

DETECTOR FOR ELECTROMAGNETIC WAVES.—A patent issued July 11 to W. S. Hogg relates to a sensitive decohering detector for use in wireless telegraphy. The detector employs the thermo-electric power changes which occur between microphonic contacts of dissimilar thermo-electric materials. There is used a comminuted mixture of nickel and zinc with selenium between terminals consisting of a fine platinum wire and a steel plug. The selenited material forms a strong thermo-electric couple with the platinum wire; the platinum wire has a small capacity for heat, so that its temperature changes quickly with the oscillating currents. The detector is placed together with a telephone receiver in one of the arms of a Wheatstone bridge.

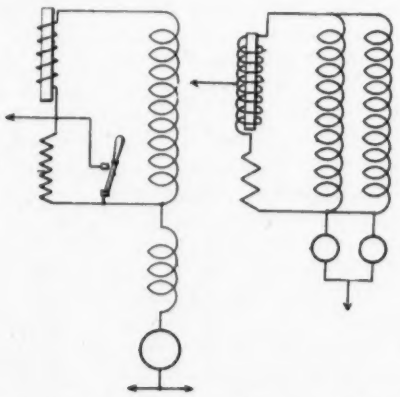
WIRELESS TELEGRAPH STATIONS.—One of the Stone wireless telegraph stations has been set up at Appledore Island, Isles of Shoals, off the New England coast. Appledore has been connected with the main land at Portsmouth, N. H., some ten miles distant, by cable, but the cable has never, it is said, worked satisfactorily and hence for the last two or three years the Island has been cut off from communication with the shore. Some little time ago, the proprietors of one of the Appledore hotels made overtures for the erection of a Stone plant, so that they could get into touch with the Government system at the Portsmouth Navy Yard. The plant was put up accordingly by the Stone Telegraph & Telephone Company, and is now working very satisfactorily. On July 11, for example, one press message of 295 words and another of 87 words went through very nicely. The Stone system is now to be installed at the Portsmouth Yard, and also on the collier *Lebanon,* which when in readiness will be sent out from the yard as a "derelict destroyer."

LAWSON ON MUNICIPALISM.—Mr. Thomas W. Lawson has now given out his views on and against municipal ownership. At a Jefferson Club dinner in Chicago he said: "You think, some of you, that the solution of our troubles is in municipal and federal ownership of our public utilities," said Mr. Lawson. "I hate to oppose your optimistic impression that in the people's administration of the railroads and gas companies lies the panacea for our deep-rooted troubles. Before I left home I was asked not to disturb the nation's new, glowing hope that in this way safety lies. I was asked to take the presidency of a national league for political ownership which is being organized, but I must be true to my convictions and I must not temporize with the facts as I know them. Municipal ownership is a will-o'-the-wisp. The idea it is circulated among the people to keep them out of mischief. It is a rattle and a rubber ring for the country to play with. If Rogers and Rockefeller and other frenzied financiers were starting over again they would ask nothing better than to begin in a world in which all the banks, railroads and manufactories were in the hands of the government, because they could steal them easier, quicker, cheaper and more safely from elected authorities than from individual owners."

IN MEMORY OF THURSTON.—Students of Sibley College, Cornell University, have ordered designs made for a $1,500 bronze tablet, which they will erect in memory of the late Dr. R. H. Thurston, formerly Director of Sibley. The tablet is being designed by Prof. H. S. Gutsall, of the College of Architecture, and will be erected in a stone niche of the new Thurston Hall of Engineering, now in process of construction.

POLARIZED ELECTROMAGNETIC WAVES.—A solution of the problem of limiting the direction of transmission of waves from a wireless telegraph station is proposed by A. Artom, of Turin, Italy, in a patent issued July 11, 1905. To obtain the desired result the inventor employs aerial conductors arranged symmetrically with respect to the predetermined direction in which the electrical transmission is to take place, so that they form a downwardly open angle with one another of 90°, each of them being inclined 45° to the horizontal. These aerials consist of lattices of parallel conducting wires. At the rear edge of the aerials are placed secondary pieces that act as screens and prevent the backward transmission of the waves and cause the waves for the greater part to radiate in the desired direction of transmission. It is stated that this form of aerial reinforces circularly and elliptically polarized electromagnetic waves, at the same time radiating these waves in only the desired direction, and thus produce a narrow bundle of rays. The production of the polarized waves is not explained.

ALTERNATING-CURRENT MOTOR USED ON DIRECT-CURRENT CIRCUITS.—When a series-wound motor is operated by alternating current, it is desirable that the ampere-turns in the field winding should be relatively low, but when it is operated by direct current the magnetomotive force of the field current should be much higher in value. In order to provide means for automatically changing the value of the ampere-turns in the field magnet winding of a motor when a change in the supply of energy is made from direct current to alternating current, and vice versa, Mr. B. G. Lamme, according to two patents issued July 11, would place in combination with the field coils suitable arrangements of resistances and reactances so as to allow a greater value for the ampere-turns in the field magnet winding when the motor is operated by direct currents than when it is operated by alternating currents. The methods employed are indicated in the accompanying illustration.



In one of these methods the field winding is divided into two parts, in parallel with one of which is placed a series circuit containing resistance and reactance. The current is introduced in the series circuit at such a point that when the current is unidirectional the major portion of it flows through both field windings, while when it is alternating only a small part of it flows through the shunted section of the field coil, as shown in the illustration. According to another method the inventor places in parallel with the whole of the field winding a series circuit containing a resistance and an inductive winding. The current is introduced at a point along the inductive winding so chosen that the proper proportion of alternating current is forced to pass through the resistance and directly to the armature, while the greater relative value of the resistance allows only a small part of any unidirectional current to flow therethrough and forces the greater portion to pass through the field coil. The diagram indicates this arrangement when two motors are operated simultaneously, the field windings being connected in parallel with each other, and the armatures being also connected in parallel with each other.

Electrical Engineers of the Times.—XIX.

PROF. C. P. MATTHEWS.

Charles Philo Matthews was born at Fort Covington, N. Y., Sept. 18, 1867. He received his primary education in the schools of his native town and entered St. Johnsbury Academy, St. Johnsbury, Vt., in 1885, from which he was graduated in 1887. After a year in business he entered Sibley College, Cornell University, and was graduated with the degree of M. E. in 1892. In 1901 he received the degree of Ph. D. from Cornell, the subject of his Doctor's thesis being "On Certain Photometric Apparatus and the Results Therewith Obtained."

Since 1892 Prof. Matthews has been engaged chiefly in teaching physics and electrical engineering, but during vacation periods, and to some extent during term time, has engaged in various kinds of engineering work. The summer of 1892 was passed at the works of the Rockford, Ill., Manufacturing Company; the summer of 1902 in the National Bureau of Standards at Washington, and the winter of 1903-1904 in the Electrical Testing Laboratories of New York City. From time to time he has acted as consulting engineer, chiefly on matters in connection with electric lighting. From 1892 to 1896 he was instructor in physics and applied electricity at Cornell University, and in the latter year went to Purdue University, Lafayette, Ind., as associate professor of electrical engineering. In 1902 he became professor of electrical engineering at Purdue, and upon the resignation of Professor W. E. Goldsborough was made director of the School of Electrical Engineering of that university.

PROF. C. P. MATTHEWS.

Prof. Matthews was for four years photometrist for the committee of the National Electric Light Association, appointed to determine the photometric values of arc lamps, during which time he directed all the experimental work and designed the apparatus wherewith to carry it on. These reports, which cover over 200 pages and represent a vast amount of labor, appear in the transactions and contain the most valuable collection of data on the subject of arc lamp photometry in existence. Prof. Matthews is the patentee of an integrating photometer for determining the candle power of incandescent lamps and other sources of artificial light, which instrument is largely used in laboratories and received a gold medal from the Louisiana Purchase Exposition. He is joint author of several books, as follows: "A Laboratory Manual of Physics and Applied Chemistry," written in collaboration with Prof. Edward J. Nichols; "Problems and Questions in Physics," in collaboration with Prof. J. S. Shearer; "Electrical Laboratory Notes," in collaboration with Prof. J. W. Esterline. He has contributed a number of papers to the Transactions of the American Institute of Electrical Engineers as follows: "The Action of Continuous and Alternating Currents on Fuse Metals" (1893); "Standard of Light" (Nichols, Sharp and Matthews, 1896); "The Photometry of the Enclosed Arc Light" (1898); "Improved Apparatus for Arc Light Photometry" (1901); "The Integrating Photometer for Glow Lamps and Sources of Like Intensity" (1902). He has also contributed articles to the *Physical Review* and to technical journals. Prof. Matthews is an associate member of the A. I. E. E. and a member of the Society for the Promotion of Engineering Education.

A Norwegian Hydro-Electric Plant.

BY C. SMITH.

NORWAY abounds in waterfalls, the hydro-electric power available being extremely large, and numerous small water power plants have been installed. By far the most important of these is the Glommen, which is not only the largest power station in Norway, but also one of the most important installations in Europe.

The River Glommen, the largest in Norway, which has its source in the northern part of the country, at an altitude of 8,400 ft., flowing from a chain of small lakes south toward Frederickstad, where it empties into Christiania Fjord. The River Vormen, which drains the Lakes Mjosen and Oejeren, also unites with the Glommen, thus increasing the output to a considerable extent. There are on the river a series of falls which have been utilized by private industries, the Glommen power plant taking advantage of the highest falls at Kykkelsrud, about 63 km. from Christiania, which it supplies with electrical energy for power and lighting purposes.

The German engineers, Siemens & Schuckert, of Berlin, who have had entire charge of the construction and equipment of this plant, encountered many engineering difficulties during their work, especially with the canal construction and embankment work, but they have now practically completed the installation, which was commenced in 1900.

From a small island in the center of the stream dams are thrown across the river to both banks. The intake, which is separated into two parts, each 41 ft. square, by a central pier, leads to the open canal, which was constructed with much difficulty, the ground being particularly unfavorable. It is slightly over a kilometer in length, with a width at the bottom of 7.5 meters, the gradient being 1 in 660.

At its lower end there has been constructed a reservoir 420 ft. in length by 66 ft. in width, the water passing from it to the turbines. The effective head is 19 meters and the flow 260 cubic meters per second, the power available amounting to about 30,000 hp. In dry weather, however, the output is somewhat lower.

Fig. 1 shows the exterior of this plant, while Fig. 2 is a view of the interior. So far there have been installed two 3,000-hp turbines and two 280-hp turbines. One of the large vertical shaft Francis type turbines was constructed by Escher, Wyss & Co., of Zurich, Switzerland, while the other 3,000-hp turbines, as well as the two smaller ones, were made by the firm of J. M. Voith, of Heidelheim-am-Brenz. The larger Voith turbine is 6 ft. in diameter and is enclosed in a wrought-iron casing. The shafts of both of the larger turbines are of Siemens steel with a diameter of one foot, their lengths being 25 and 27 ft., respectively.

FIG. 1.—EXTERIOR VIEW OF GLOMMEN POWER STATION.

When completed the plant will contain in all four 3,000-hp turbines, three 280-hp turbines and eight 5,000-hp turbines. The turbines of 3,000 hp capacity already installed have a speed of 150 r.p.m. and an efficiency of 75 per cent at a head of 52 ft.

The two large turbines are direct-connected to three-phase, alternating-current generators, while the smaller ones drive 180-kw, direct-current machines which supply current for excitation of the alternators and for lighting the station.

The three-phase alternators are of the rotating field type, and each has a capacity of 2,500 kw. The magnet wheel carries 40 poles and revolves at a speed of 150 r.p.m. The current has a frequency of 50 periods per second and a potential of 5,000 volts. The efficiency of these alternators is 96 per cent. The shaft of the turbine, revolving portions and rotating field weigh in all about 32 tons.

The current supplied by the alternators is raised to a potential of 20,000 volts by step-up transformers of 950 kw capacity each. Fig. 3 shows these oil-cooled transformers, which are of a new German design. The windings are traversed with numerous passages so that both the insulation between the winding and the core as

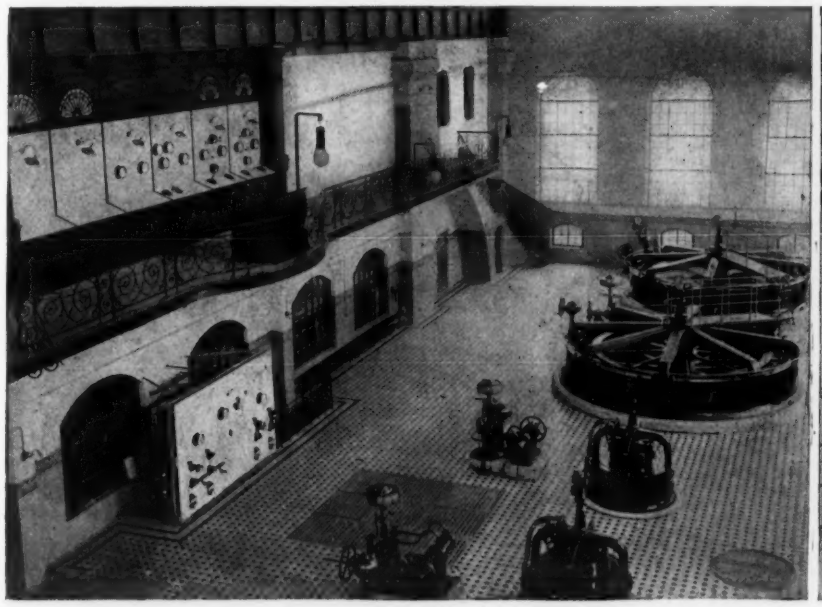


FIG. 2.—INTERIOR OF STATION, SHOWING ALTERNATORS AND EXCITERS.

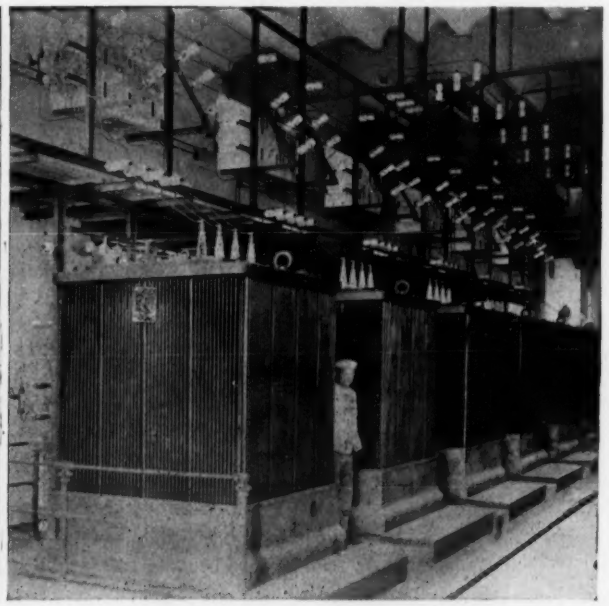


FIG. 3.—TRANSFORMER ROOM, 20,000-VOLT TRANSFORMERS.

well as the insulation between the individual coils is very efficient. Cooling is also obtained more readily and easily with this kind of transformer.

Five transmission lines, four to the north, and one to the south, convey the current to seven sub-stations along the route, the last station being located at Slemmestad, about 87 km. from the hydro-electric plant. One line also leads to Christiania, 63 km. distant. Oil-cooled transformers similar to those used at Glommen, reduce the

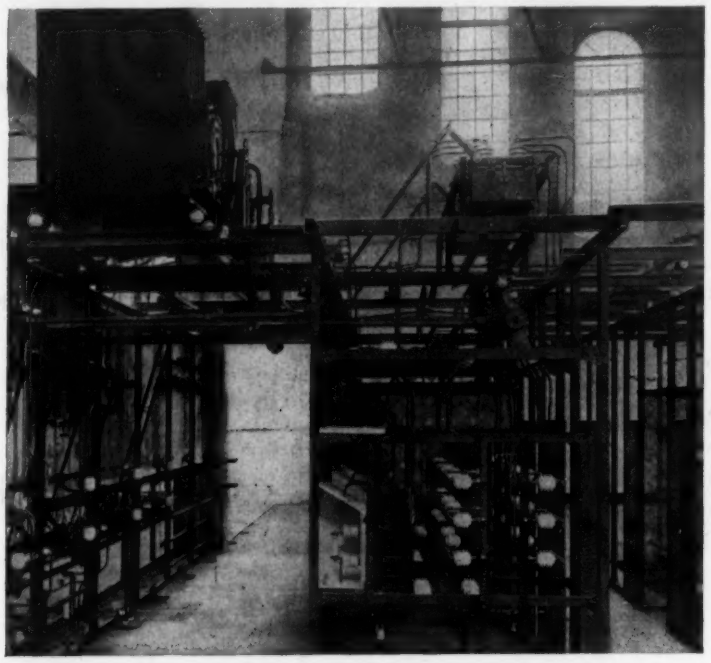


FIG. 4.—ROOM BELOW THE SWITCHBOARD. HIGH-TENSION APPARATUS.

potential from 20,000 to 5,000 volts at these stations. The power is then either used at this pressure or stepped down still further, to either 220 or 110 volts by smaller transformers.

The illustration, Fig. 4, shows the high-tension apparatus, etc., in the room under the switchboard, which can be seen on the left in Fig. 1, mounted on a gallery. The switchboard is constructed of white marble and carries the low-tension apparatus. All of the six panels are not in use at present, but they will be placed in service in the near future when the installation has been completed.

Design of the Telefunken System.

BY A. FREDERICK COLLINS.

IN a recent article published in the columns of this journal, the amalgamation and subsequent rise of the Gesellschaft für Drahtlose Telegraphie, or the Wireless Telegraphy Company, in the province of space transmission and its immediate possibilities were described in detail.

There are several additional interesting features relating to the system proper as developed by this corporation, and these include a new arrangement of the oscillating circuits, diagrams of the apparatus that embody both the Braun and the Slaby-Arco ideas, a multiple spark-gap and other devices, all of which have been combined to form the "Telefunken" system.

In the beginning of the art the effort to obtain increased distances consisted chiefly in enlarging the induction coil, improving the coherers and adding to the electrical dimensions of the aerials. In 1900 the principle of electrical resonance which offered a theoretical promise of selectivity was then taken up and nearly all the workers in wireless concentrated their attention on its practical consummation until a year ago, when every possible combination of tuned and syntonized circuits had seemingly been evolved.

During the past year a new line of research engaged the busy brain of the wireless physicist and inventor, with the result that much new data have been adduced and information made available concerning the damping of the spark-gap and oscillator circuits. It is well known that when striking distance of the disruptive discharge is increased beyond a certain critical length the potential energy stored up in the oscillator system is equalized through the spark as a direct current due to the resistance of the intervening medium.

With a single spark-gap there was usually a very great loss of energy, but it has been found that by segregating the spark this untoward effect is eliminated. The investigations along this line by the electricians of the Telefunken system have been due very largely to the measurements made with the odometer, and hence the radical departure from the hide-bound notions that have hitherto prevailed, and with the result that new types of instruments have been constructed.

Upon this knowledge the above company has found it feasible to completely change the dimensions of the oscillator system and hence modify the resulting period of oscillation without sacrificing to the slightest extent the range of effective signaling. In the equipments under consideration a net of wires is utilized for the emission and reception of electric waves, and as in other wireless stations the same aerial serves both purposes, the simultaneous throwing in of secondary and out of the sender, and vice versa, being accomplished through the medium of a switch.

The necessity of a properly proportioned aerial has been recognized for several years where the best results are to be expected in the matter of accuracy and distance. The equipping of no less than 300 stations, both land and marine, by the experts engaged in the furtherance of this particular system, has naturally taught them many facts that can only be learned in the school of actual experience. Among these may be cited the most suitable length of aerials from the earth and the distances between the wires of the same aerial, the differences in the frequency of oscillation permissible, the opposing elements produced by extraneous conductors in the field of force, etc.

A great deal of time has also been bestowed in the past two years on the best methods for earthing a terminal of the oscillator and resonator circuits. Prof. Ferdinand Braun was the first, I believe, to make use of an artificial earth, and then followed a long line of experiments participated in by almost everyone interested in the improvement of the apparatus, and these finally led to the use of conducting substances distributed about the base of the earthed wire.

In the Telefunken system in so far as floating stations are concerned, the original scheme of earthing is adhered to, for the surface of the ship's bottom presents an ideal connection with the earth, the resistance amounting to only a few ohms. Permanent stations where they are not in close proximity with the sea offer a different and more difficult proposition, and for this reason a cross between the original Marconi plan of earthing and the artificial areas of Braun is used.

This device, termed an electric counterpoise, consists of a large, flat, circular conducting surface placed horizontally upon the ground and insulated from it. It is evident that the electric counterpoise acts as the opposite of the aerial system and that the earth acts inductively upon the former instead of by conduction, as it does where a direct contact is made. An inductance is connected between the aerial and the counterpoise, and by this method two oscillatory circuits are formed.

To better understand the nature of these circuits, let it be remembered that in the oscillator as originally designed the lower end of the aerial was connected to one side of the spark-gap, while the other side led to earth, and in this system the aerial wire and the earth itself act like the opposite coatings of a condenser. It is stated by Count Arco that it is impossible to convert large amounts of energy into electric waves by this method, for in the first place the capacity of the aerial is limited and an increase of energy can be had only by augmenting the charging current.

In order to fulfill this condition a long spark was requisite, but when the length of the spark was increased to 5 cm. or more, and was directly connected with a 60-meter aerial, the disruptive discharge took the form of an arc. To obviate this serious defect the primary of the induction coil used for energizing the secondary, which in turn charges the oscillator circuits, is tuned to the period of alternation, for in this case a single-phase current is required. With this arrangement a spark of 30 cm. can be obtained with an aerial wire 60 meters in height. The only limitation imposed in using these long spark lengths lies in the matter of properly insulating the aerial for the high potential.

The difficulty of the conversion of high potentials and large current strengths into radiant enermy may in this way be overcome, while it has been shown that in the ordinary spark-gap the increase in range does not rise in nearly the same ratio as the increase of

the charging energy, due to the losses occasioned by lengthening the spark, and again the increase in potential at the beginning of the discharge is more than exceeded by the damping factor, but these faults may be circumvented by the application of the segregated or multiple spark-gap.

That the heat losses may be reduced to a minimum, there is employed a method of distribution in which either small capacities in the form of condensers or inductances in the form of coils are introduced in multiple, so that the potential is proportionate to the length of the spark-gap. The invention of this new spark-gap is credited to Herr Randahl, and by its means the effective range rises proportionately to the length of the disruptive discharge. With this new emitter it has been found possible to bridge a distance of 250 km. with an initial energy of 90 watts and an aerial 32 meters in height.

In connection with a simple open-circuit oscillator the multiplex discharge, as it is termed, it is claimed to be possible to obtain a much higher degree of accuracy in tuning the receiver, as will be subsequently shown. The company, however, desires it to be understood that it is still pinning its faith to the compound system energized by Leyden jars as designed by Prof. Braun and patented by him October 14, 1898, and this arrangement has been further improved by the application of Braun's new current distributors.

The two types of compound oscillators employed in the telefunken apparatus are indicated in Figs. 1 and 2. The first is recommended for floating equipments, because it is simple, easily adjusted for varying wave lengths and on account of the slight tensions to which the aerial is subjected. The closed circuit includes a non-adjustable condenser, C_1, the segregated spark-gap, F, and a variable inductance coil, L. One terminal of this coil is earthed, while the opposite end encloses contact with the aerial, A, through the tuning inductance, I, and the condenser, C.

In Fig. 2 is shown a portable transmitter in which an aerial composed of a single wire is elevated either by means of a kite or a balloon, and in this way two wave lengths are available, the first being that emitted by its natural period and the second that of its first upper octave. It is in this apparatus that the wire gauze counterpoise is used.

This type of oscillator comprises a condenser, C, having a capacity of fixed value which is charged by the secondary of the transformer

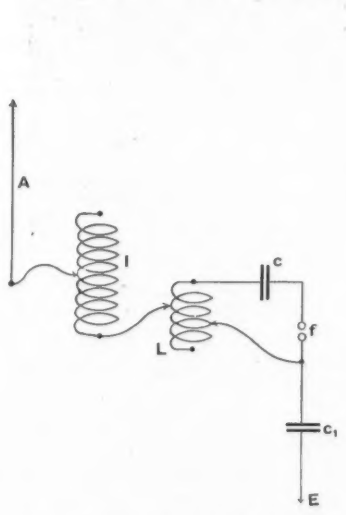


FIG. 1.—TRANSMITTING CIRCUITS FOR FLOATING EQUIPMENTS.

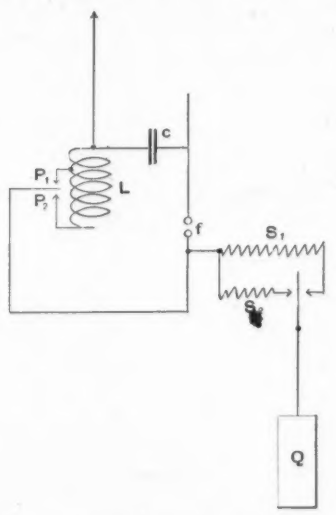


FIG. 2.—TRANSMITTER CIRCUITS FOR PORTABLE EQUIPMENTS.

through the segregated spark-gap, F, and the tuning coil, L; when it is desired to emit short wave lengths it is only necessary to insert a plug at P, or if, on the other hand, the long wave length is required all the turns of the inductance are brought into action by pushing the plug home at P_2.

One side of the gap is connected direct to the aerial through the condenser, C, while the opposite side leads to the counterpoise through the inductance coils, S_1 and S_2. Where the natural period of the oscillator is used the tuning coil, S_1 and S_2, is used with its overtone. By varying these plugs the periods of the circuits are changed and hence give rise to the two different wave lengths employed.

Highly tuned receiving circuits are of greater importance in the military and naval arts than in the merchant marine, as in the former sharp tuning may effectually prevent the agglomeration or annihilation of the telegram by the enemy's waves, even if these are of superior intensity, while on transoceanic steamers all vessels must be able to receive from any ship or shore station.

In Fig. 3 the granular detector is shown at F, while the condenser, C, having a capacity of large and fixed value, compared with that of the detector, is included in the circuit with the latter. The inductance coil, I, has three adjustable contacts, a, b and c, and by

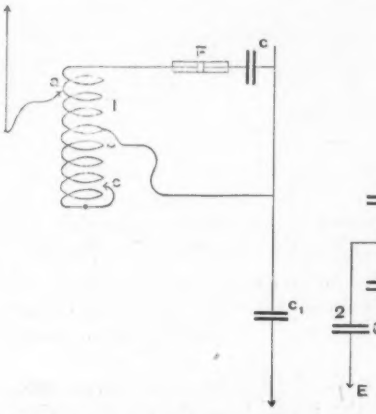


FIG. 3.—TIGHTLY COUPLED RECEIVER CIRCUITS.

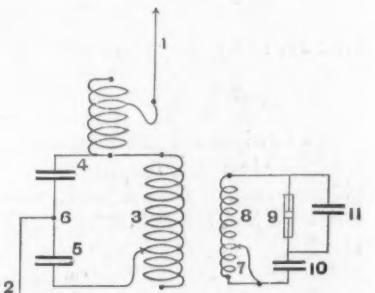


FIG. 4.—LOOSELY COUPLED RECEIVER CIRCUITS.

shifting the position of b the coherer circuit may be tuned without difficulty. The contact, c, permits the turns of the inductance to be short-circuited, thus preventing the oscillations from wasting their energy in the turns that are not used. From the contact b a wire leads to earth through an adjustable condenser, C_1, and from the point a a wire leads to and connects with the aerial.

To tune the latter the number of turns of the inductance, a and b, are varied until the right value is had, and then the proper proportion of capacity is obtained by adjusting the condenser, C; hence the greater the number of turns between the points a, b, per given wave length, the smaller may be the value of C, and the closer the coupling of the open and closed circuits the less the instrument will be in tune. This is the type of receiver the German writers mean when they speak of a "tight coupling."

A "loosely coupled" oscillator, to use their terminology, is shown in Fig. 4, and consists of two closed circuits inductively connected by a small oscillation transformer coil. In this type the antenna is designated by 1, an adjustable condenser by which the aerial is tuned to earth by 2, and by carefully choosing the condensers 4 and 5, which have a permanent value, the closed primary resonator circuit is coupled to the antenna. The secondary resonator circuit, 8, in which the coherer is placed, is thus "loosely coupled" to the primary by the transformer coils, 3 and 8. The term "loosely coupled" is taken to mean in this case that there is a large intervening space of air between the primary and secondary coils so that any deformation of the primary wave cannot appreciably affect the secondary circuit.

A sliding contact, 7, renders the inductance of the secondary of the oscillation transformer adjustable within certain limits. The terminals of this winding lead to the coherer, 9, through an adjustable condenser, 10, for tuning, while paralleling the devices 9 and 10 is the condenser, 11, the capacity of which is infinitely greater than that of the detector. The aerial need not be connected to earth, but an electric counterpoise can be employed instead with equally good results. Where a transformer is used, as shown in the diagram, Fig. 4, instead of combining the resonator systems, as in Fig. 3, the untoward influences of atmospheric electricity may be further diminished.

With inductively associated resonators a greater degree of perfection in tuning may be approached, and with this type of receiver it has been found possible to tune the receiver to about 1 per cent, and it is stated that such tuning suffices absolutely to discriminate between the waves intended for it and the counter action set up by the enemy's emitter, assuming that the intensity of the opposing instrument is practically the same, and that there is a 4 per cent difference in the waves. This striking achievement is largely the result of using the segregated spark-gap and is due somewhat to the reduction of the damping of the circuits.

Still more remarkable is the simultaneous reception of two messages from different stations having a wave difference of 30 per cent by the use of two distinct antennæ, and it is even possible to connect both receptors to a common aerial and receive the dual telegram. Where a single vertical wire is employed for the reception of two different wave lengths simultaneously, the tuning of the receiving systems is attended with much difficulty, and the resonator circuits must be connected with the antenna by means of oscillation transformers, the primary and secondary windings of which are differentially associated.

Electrical Features of the Portland Exposition.

The Lewis and Clark Exposition at Portland, Ore., departing from the precedent set by the St. Louis Exposition in the matter of illuminations, has no separate power station on the grounds. After estimates had been obtained, showing that it would cost $400,000 to install an adequate power plant, a proposition was accepted from the Portland General Electric Company for a service of about 100,000 lights for the entire exposition season at an aggregate cost of about $80,000.

For the purpose of supplying the Exposition with illuminations, and with a view to increasing the capacity of its public service to meet prospective growth and increased demand for light and power in the city and its environs, the Portland General Electric built a steam power plant situated one-third of a mile from the Exposition grounds, and installed 12,000 hp in addition to the 12,000 hp at its water power plant at Willamette Falls, 15 miles from Portland. The illumination of the Exposition requires about 4,000 hp.

FIG. 2.—GENERAL VIEW OF BUILDINGS.

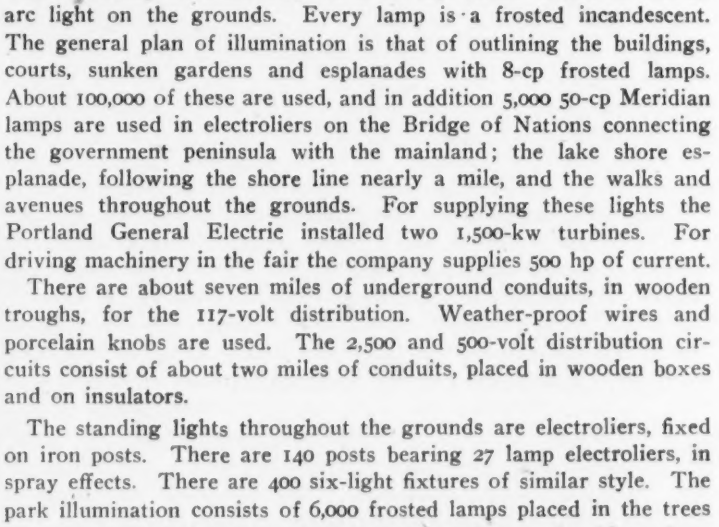


FIG. 3.—THE "TRAIL."

The service is fed to the fair on 2,200-volt circuits, and is distributed to various transformer pits located just outside the buildings.

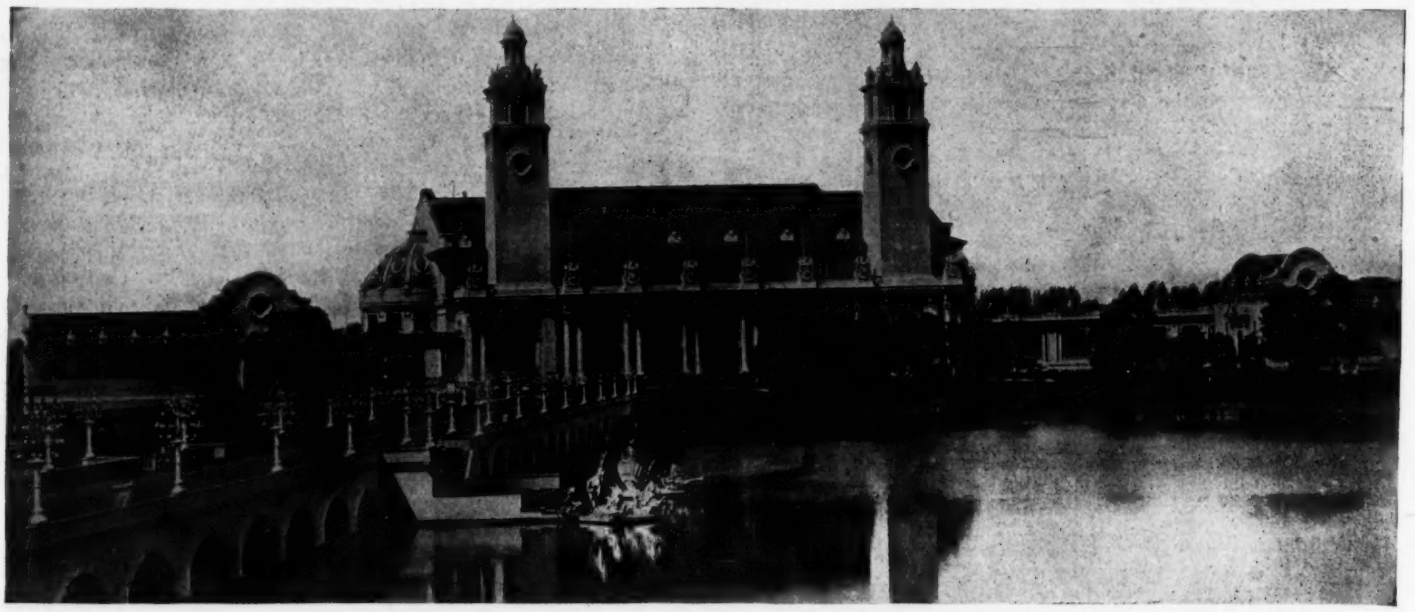


FIG. 1.—GOVERNMENT BUILDING.

The secondary wire distribution is at 117 volts. There is not an arc light on the grounds. Every lamp is a frosted incandescent. The general plan of illumination is that of outlining the buildings, courts, sunken gardens and esplanades with 8-cp frosted lamps. About 100,000 of these are used, and in addition 5,000 50-cp Meridian lamps are used in electroliers on the Bridge of Nations connecting the government peninsula with the mainland; the lake shore esplanade, following the shore line nearly a mile, and the walks and avenues throughout the grounds. For supplying these lights the Portland General Electric installed two 1,500-kw turbines. For driving machinery in the fair the company supplies 500 hp of current.

There are about seven miles of underground conduits, in wooden troughs, for the 117-volt distribution. Weather-proof wires and porcelain knobs are used. The 2,500 and 500-volt distribution circuits consist of about two miles of conduits, placed in wooden boxes and on insulators.

The standing lights throughout the grounds are electroliers, fixed on iron posts. There are 140 posts bearing 27 lamp electroliers, in spray effects. There are 400 six-light fixtures of similar style. The park illumination consists of 6,000 frosted lamps placed in the trees and shrubbery, and among the vast gardens of roses that bloom here continually. Clusters of twenty-seven 50-cp lamps are placed around the sunken gardens of Columbia Court, alternating with large urns filled with gorgeous flowering plants. Other similar electroliers occupy pedestals on the grand stairway, and smaller fixtures made

up of six lamps are used around groups of statuary and along main walks.

Mr. James R. Thompson, the electrical engineer who designed the

FIG. 4.—FORESTRY BUILDING.

illumination scheme, and has charge of it, conceived something new in the submarine illumination of Guild's Lake, around and across which body of water the Exposition is built. The Exposition's main lamps, as is also the government group of buildings. Viewed from either side of the axis of the fair formed by this bridge, the electrical display is the same. The water feature is 220 acres in extent, the largest ever enclosed within an Exposition fence. Along the lake shore esplanade, and on either side of the Bridge of Nations for its entire length, Mr. Thompson has placed, at intervals of three feet, 50-cp lamps in marine receptacles, on the bottom of the lake. The lake is about 8 ft. deep. The illumination is sufficient to enable spectators on the bridge and along the esplanade to see objects at the bottom. The government fish hatcheries have stocked the lake with carp, salmon and bass, and these may be seen swimming to the lights and examining them with fish-like curiosity that does not diminish. An element quite unexpected by the electrician, and occasioning his growing dissatisfaction, is the increase of organic matter in the water of the lake since its natural outlet and inlet from the river were closed to deepen it during the Exposition season. The pumping of 30,000,000 gallons of water daily into the lake from the Willamette River, a clear river rising in the Cascade Mountains, has the effect of retarding, however, in a degree, the growth of the objectionable matter.

The architecture of the fair is brilliantly displayed by the scheme of illumination, and the effect at night is very beautiful. Every building on the grounds, including large and small exhibit buildings, State buildings, Government and fair administration buildings, the

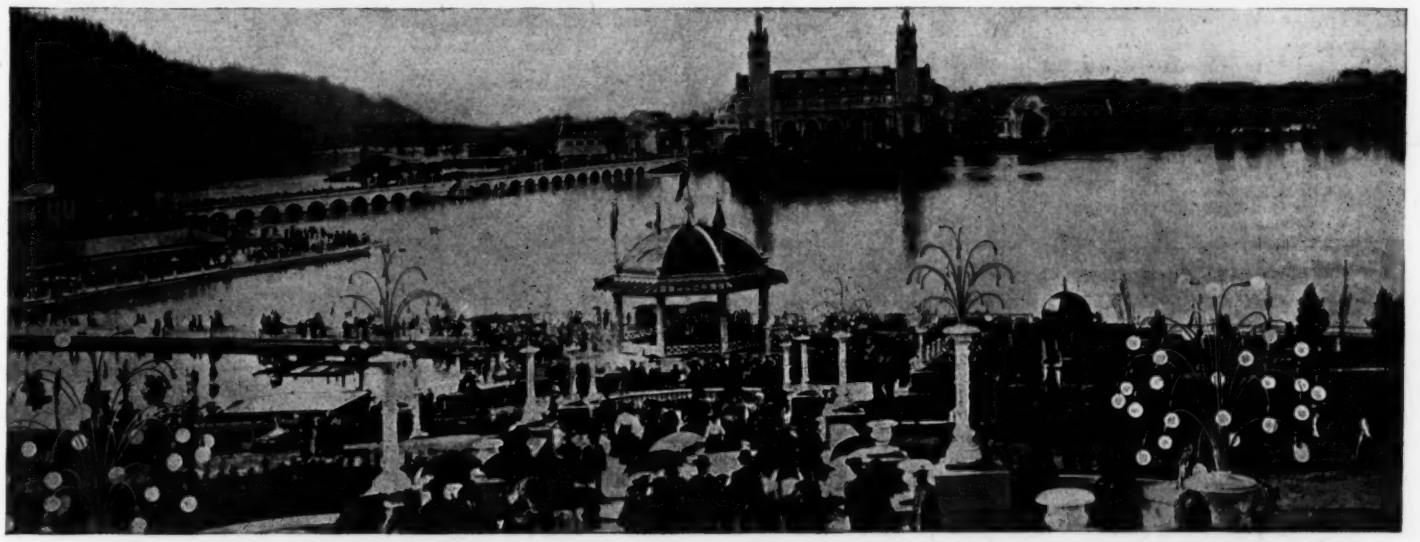


FIG. 5.—GENERAL VIEW ACROSS GUILD'S LAKE, SHOWING BRIDGE OF NATIONS.

array of buildings stands along the gently rising slope of an eminence at the south bank of the lake, and the government buildings are in

Trail, the Bridge of Nations, the American Inn and the grand stairway, and the long esplanade stretching a mile along the shore of

FIG. 6.—BIRD'S EYE VIEW OF EXPOSITION GROUNDS.

the form of a crescent on an island in the middle of the lake. They are connected by a "Bridge of Nations," 2,000 ft. long. The spans and arches of this bridge are outlined with frosted incandescent

the lake, are outlined with the soft glow of the frosted incandescents. Searchlights are operated nightly from two towers, one on each side of the lake, and from the roof of the Agricultural Palace.

Terminals and Distribution Boards in Telephone Exchanges.

By ARTHUR V. ABBOTT, C.E.

TIME was when the problem of bringing the various lines into the telephone exchange taxed the invention of the telephonist, for when all lines were aerial they naturally converged to the roof of the building, and to place thereon a structure capable of resisting the stress of some thousands of lines, so designed as to maintain each in electrical isolation was a herculean task. All vestiges of such practice have vanished with the adoption of the aerial cable and the development of the conduit, for it is essentially true to state that now no open wires are carried into exchange buildings.

Even in the smallest installations the open wire is gathered into a cable a few poles away from the office, thus compacting the lines into a small compass and rendering their introduction into the building through a convenient hole in the wall an easy matter. In the larger cities exchanges are located in the more crowded portions and the circuits are universally under ground. Hence, it is usual to build in the street what is frequently called an "office manhole," to which all conduits converge and in which they end. From this manhole to the basement of the exchange building the cables are carried either in an open tunnel, the method almost universally adopted in the older offices, or by means of series of short ducts, now the prevalent practice.

The tunnel is usually a passageway some 4 ft. wide and 6½ ft. high, excavated beneath the street, and lined and arched with brick, providing a structure of ample strength to carry the heaviest traffic of a busy street. Into the masonry of the side walls iron supports are built, thus furnishing a series of shelves or racks on which the cables may rest. So far as ease in installing or rearranging cables is concerned, nothing can be more desirable, as there is ample space to do anything one pleases. To find room among street structures for such a tunnel is a difficult, often impossible matter, to say nothing of its expense, so by building a short subway of ducts connecting the office basement with the street manhole, both of these objections are avoided. In many cases such a conduit must provide for a very large number of cables, and in order to render all accessible much ingenuity must be displayed. Usually a broad flat conduit lends itself most readily to cable installation, and by fanning out the separate ducts at the basement wall sufficient room to handle cables can be secured.

There is some difference of opinion as to the best method to adopt after the cables reach the inside of the building. It was formerly the custom to end the cables in iron cable heads carried in a rack attached to the building wall. Such cable heads carried the protective devices, and house cables from them extended to the distributing boards. The iron cable heads are expensive to install, and even when carefully connected to the cable they can by no means be considered moisture-proof, and they take up so large an amount of space as often to require a room by themselves. As the protector forms the most convenient point at which to test for trouble, the cable heads should be placed as near as possible to the switchboard or else much time will be expended in going to and fro. For these reasons it is becoming customary to place the switchboard and distributing board close together on the same floor, as is shown in Fig. 1; then the street cables are carried as near as possible to the distributing board and terminated in potheads.

From the potheads twenty-pair switchboard cables are run to the distributing frame. In some cases the street cables have been carried to and laid on the shelves of the distribution board, the individual circuits being extended to the terminals of board by means of okonite, but the pothead when placed on the shelf of the distributing board takes up so much room as to make this method inadvisable. The nearest arrangement is to set the potheads on a floor below that occupied by the distributing board, and directly beneath it. Then by means of a slot in the floor the cables from the head can run directly to the terminals on the frame. It is usual to place the operating rooms of large offices on the top floors. In many cases this necessitates a long vertical run in the building. It is impractical to suspend the cables from one end as the lead sheath is so soft that the weight of but a few feet would pull the sheath apart. So a shaft must be designed to provide a cable support every few feet. Where one wall of the building is free from windows it is convenient to build the shaft only deep enough to take one cable, and as wide as may be necessary to accommodate the desired number. Fire-proof doors are provided on each floor to give access to the shaft, and as often as every ten feet the cables are supported by clamps in the wall.

When potheads are used protectors must be provided for, and it is now usual to place them on the switchboard side of the distributing frame. The advocates of the pothead claim that its use affords a surer protection against the entrance of moisture than the cable head, that it takes up much less space, costs less to install, and that less protection of a cheaper and more accessible form can be used

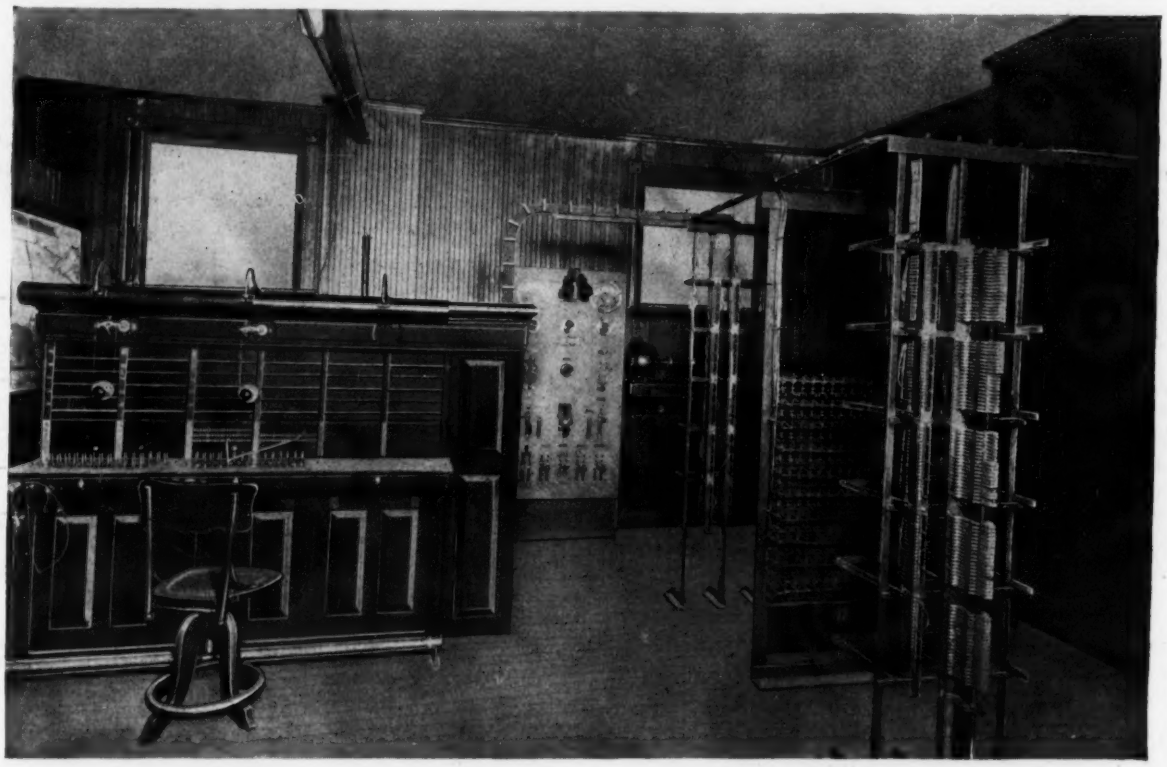


FIG. 1.—GENERAL ARRANGEMENT OF EXCHANGE APPARATUS.

on the distributing board. Those who favor cable heads, while admitting the advantages cited for the pothead, believe that the difference in cost is more than repaid by the better opportunity that the cable head affords for testing and rearranging circuits when a cable is spliced, and by the fact that protection on the heads guards *all* the wiring inside the building, while if it be placed on the switchboard side of the distributing frame the jumpers in the frame are entirely unprotected, thus leaving unguarded a spot where a little fire may do much injury. This objection, which was weighty in the days of wooden boards, and parafined wire, now loses much of its force with the employment of iron frames and flame-proof, wool-covered jumpers, and so the pothead is on the whole the favorite method. In order to combine the merits and omit the defects of both, the plan of using potheads for the street cables and placing the protection on a special frame in cabinet set between the pothead and the distributing board is sometimes adopted. Where this method is adopted it is usual to place the protectors on long strips, so mounted as to be easily accessible from all sides, and enclose a sufficient number of strips in a cabinet, as shown in Fig. 2.

From the end of the street cable, however terminated, the circuits must be extended through a longer or shorter run to the distributing board. As such a run is inside the office building and may be kept reasonable dry, house cable is adopted. When potheads were employed, it was considered necessary to splice a length of rubber-

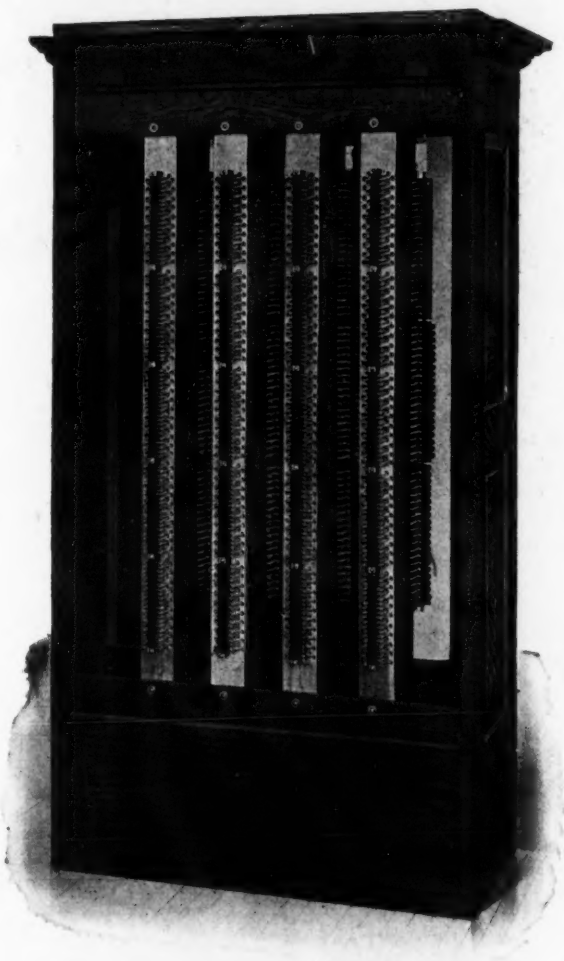


FIG. 2.—PROTECTOR CABINET.

covered wire to the street cable. This idea was founded on the theory that all the fibrous materials (cotton, etc.) used as insulators are composed of microscopic tubes which it is impossible to seal hermetically; hence if such cable were used, moisture would sooner or later reach and destroy the paper cable. Prolonged experience has shown that such fear is largely unfounded, for there are many hundreds of potheaded cables to which silk and cotton switchboard cable, either leaded or unleaded, have been spliced, and in which no deterioration of insulation has been noticed. Lead-covered, wool-insulated cable has also been used, because wool is both less hygroscopic and less inflammable.

The distributing board is one of the most important, yet often least comprehended piece of apparatus; its object is to afford an easy method of changing the relation of the wire plant circuits and the switchboard circuits; in theory it is exceedingly simple, in practice somewhat complicated. Referring to Fig. 3, suppose *A B* to be a street cable, having its ends fanned out and each circuit connected directly to the line signals in the switchboard. Such a diagram illustrates an office without a distributing board. It is easy

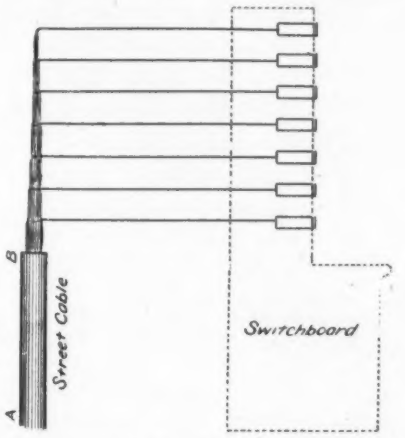


FIG. 3.—DISTRIBUTING BOARD OMITTED.

to imagine a thousand causes that will render it desirable to change a cable circuit from one line signal to another. According to the arrangement of Fig. 3, it would be necessary to cut the wires from the cable to the board and splice in new pieces. Such a practice would in a short time destroy the best installed plant. Now suppose that in Fig. 4 the street cable wires be extended to a strip on which a number of binding posts are placed, and that each wire be soldered permanently to its post. Also that the switchboard circuits be similarly extended to and terminated on a second strip supplied with binding posts, placed a short distance away from the first. Evidently any line in the cable can be at once connected to any one in the switchboard, by simply running a piece of flexible wire between the respective binding posts to which the wires are attached. Neither cable or switchboard circuits are disturbed, there is no cutting or patching, simply the loosening and tightening of a couple of screws, and neither line need be open more than a few seconds. Such is the distributing board. In very small offices the *"cross-connecting board,"* as it is often called, is nothing but a strip of varnished wood, carrying two rows of binding posts, or even two rows of

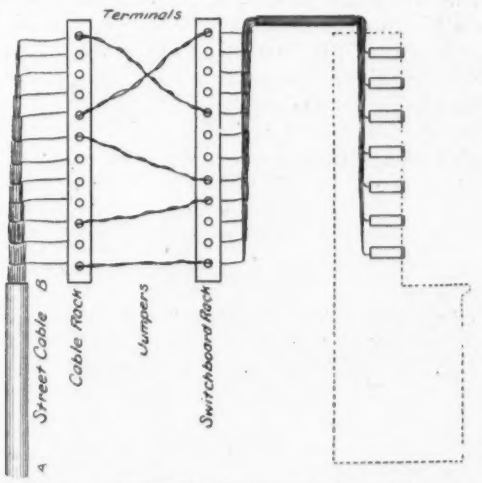


FIG. 4.—DISTRIBUTING BOARD INSTALLED.

metal pins to which the subscribers' circuits and switchboard circuits are attached, and between which the flexible wire jumpers run.

When a telephone line becomes inoperative the difficulty may lie either in the wire plant between the office and the subscribers' premises, or in the switchboard apparatus and its circuits. As the distributing board forms a temporary connection between these two, it logically becomes the point from which the inspector seeks to locate trouble, by opening the jumper and testing out toward the sub-station, and in toward the switchboard.

As the distributing board is placed at the end of street cables, it becomes the natural location for protective devices. The distributing board, therefore, must provide for three functions: It must enable a temporary connection to be made rapidly and easily between any wire plant and any switchboard circuit; it must lend itself

readily to the operations of testing for protection. Consider now how the various boards fulfill these requisites. The simplest distributing board is literally a "board," usually from 8 in. to 12 in. wide, and 5 ft. to 8 ft. long, made of hard wood, preferably maple, and thoroughly dried and varnished. Along one edge is a strip of wood carrying binding posts, while on the other edges the protective devices are arranged in a row on about the same spacing as the binding posts.

The cable from the switchboard is usually either in the space formed by the strip carrying the posts and the main board, or else directly on the back of the board, each of its wires being soldered to the end of the binding post within the strip, or if the post is supplied with two nuts, held under the lower one. In a similar manner the wire plant cable is attached to the back of the board on the protector side, each wire being attached to a post or screw that may be seen between the carbon plates and the fuses or heat coils. To connect any wire plant wire to any switchboard circuit it is only necessary to insert one end of a flexible wire under the screw at the inner end of the fuse, run it longitudinally along the board to the binding post of the desired switchboard circuit and clamp it. Pins are driven into the board about every 6 in., around which the jumpers may be bent, and thus carried nearly longitudinally throughout their entire course. Fig. 5 shows a view of a distributing board designed on this general plan, though the details are slightly different, in the arrangement of the protectors and use of a ring to guide the jumpers instead of a wood pin.

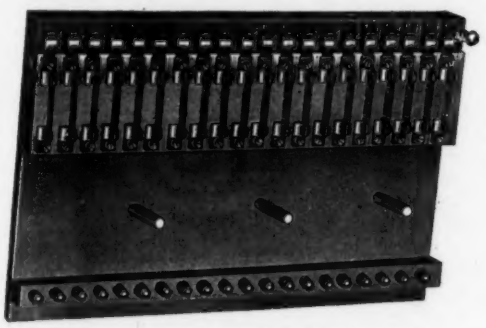


FIG. 5.—VIEW OF DISTRIBUTING BOARD.

Supposing the protectors to be set on half-inch centers, a hundred lines will need a board 50 in. long; a very convenient size, but for 200 lines a length of more than 8 ft. would be needed, making the board inaccessible. It is impractical to use two boards and connect from one to the other. To secure greater capacity the most obvious design is to bring all the switchboard cables to a series of strips either vertical or horizontal, and all the wire plant cables to a similar set placed a short distance away, say 2 ft. to 3 ft., with an open space between them, through which the jumpers can be run.

The modern iron frame distributing board presents a very neat solution of the problem, As now built, distributing boards consist of a number of panels built of angle iron. Fig. 6 shows a single panel of an approved design. The height is usually regulated by the room in which it is to be placed or by the convenience to the wire chief in reaching the terminals. The length, as will be presently shown, depends only on the desired capacity, while the width or distance between opposite sides is also a function of the capacity. The base is a piece of light 2.5 in. by 2.5 in. in angle, the uprights are 1.5-in. or 2.25-in. angles, the horizontals are supported by a strip of 4-in. by ½-in. flat set vertically, as shown on the left hand. Theoretically, boards of different sizes could be proportioned of different sized shapes, but practically the saving in iron would not pay the expense of a new design and the cost of stocking a great variety of shapes. For a 5,000-line board the base would be about 33 in. long. The distance from the face of the arrester strip to the center of the vertical bar 9 in. from the center of the vertical to the face of the horizontal runs 20 in., with a clear space between shelves 9 in. Horizontal spacing of arrester bars 8 in., spacing of horizontals runs 9 in.

As the board is formed of single bays like Fig. 6, any capacity may be secured by changing the number of bays. A complete board is shown in Fig. 7. Fig. 8 is a section through a shelf of such a board. The street cable enters along the horizontal run and is attached to clips. The switchboard cables extend vertically along each upright and are fanned out into one side of the protectors. From the other side the jumpers run to the cable conductors. From this arrangement the cables side is usually called the horizontal side and the switchboard side the vertical run.

The method of calculating a distributing board is as follows:

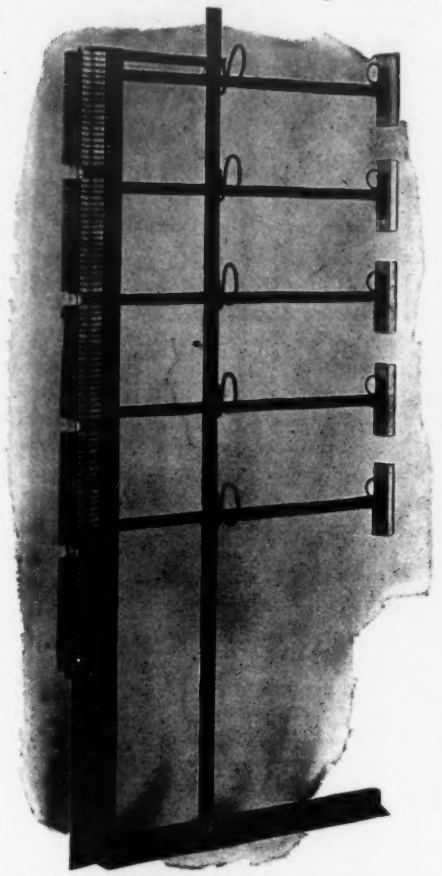


FIG. 6.—SINGLE PANEL OF DISTRIBUTING FRAME.

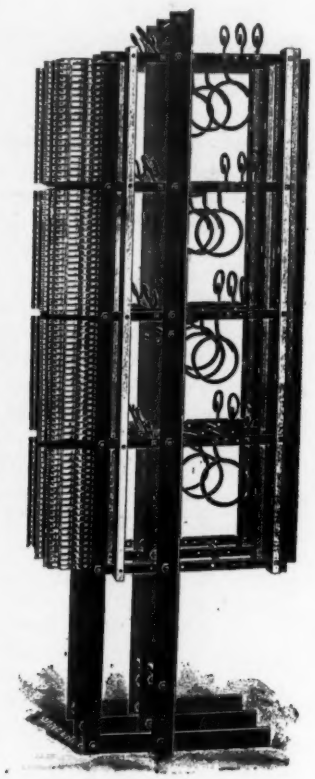


FIG. 7.—COMPLETE DISTRIBUTING BOARD.

Assume a 4,000-line board required; on account of dust it is inexpedient to set arresters nearer than a foot to the floor; without a step ladder a man cannot work on an arrester over 6 ft. from the floor. Hence, the available vertical space is 5 ft. If arresters are set on ½-in. centers, there will be 120 pairs on a vertical; the number of verticals will be 4,000/120, say 34 strips, to which must be added an allowance for private lines, trunk-line call wires, etc., or say from 40 to 45 strips for the entire frame. With verticals on 8-in. centers, the frame would be from 27 ft. to 30 ft. in length. As the frame is 6 ft. high, there will be room for eight horizontal strips on 9-in. centers. As there are no arresters, less space is required, ⅜-in. centers being ample; thus the horizontal runs give space for 7,600 pairs. Usually the cable wire is about 30 per cent

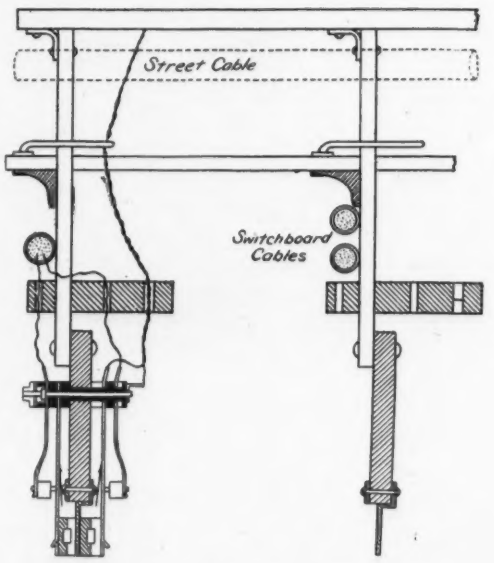


FIG. 8.—SECTION OF DISTRIBUTING BOARD.

in excess of the switchboard, so space for say 5,500 lines must be equipped, which will need about six runs.

The clips for the horizontal or street cable side are simple. A base block of maple is provided long enough to carry twenty pairs. On this a strip of hard rubber is fastened, and the terminals proper, consisting of pins or narrow strips of metal with a slot or groove in each end, are driven through the rubber. To the ends of the metal connector thus provided the cable wire and corresponding jumper is attached by thrusting the wire into the slot and touching it with a hot soldering iron.

The original form of distributing board protector devised by the American Bell Company is shown in Fig. 9. One side of the line enters by Spring *A*, traverses this spring to the heat coil, *B*, thence through the heat coil in the direction of the arrows to spring *H* and bolt *C*, through bolt to terminal *D*, and thence to switchboard. The return wire enters the switchboard terminal, *E*, passes in the direction of the arrow to heat coil *B'*, thence to the line spring *F*. It will be seen that the springs *F* and *G* bear upon carbon plates that form an open space cut-out. Each heat coil contains a small pin which bears upon a thin spring that is attached underneath the main springs, *F* and *G*. In case of an abnormal current the solder which holds this pin is melted by the heat developed inside the coil. The springs, *H* and *I*, then force the pin inward, and ground it upon the ironwork.

For common battery installations it is necessary to ground the outside line, and to open the switchboard side, or otherwise the grounding of the common battery may produce disastrous results, and in order to avoid prolonged injury to the service it is desirable that an alarm should be given whenever a protective device operates. This is accomplished by placing an alarm bell and battery in circuit with all protectors and ground. When any one fails the bell rings. In the Cooke protector (Fig. 10) the heat coil is inserted in a small carbon block placed between the line springs. In the center of this block there is a metal stud which carries a resistance coil and to which a copper rivet is soldered. The carbon and the contained heat coil are warmed by the passage of an abnormal current, and this unsolders the metal pin. In the older forms of heat coils the repairing was a difficult matter, requiring an expert mechanic and special tools. All modern protectors afford great facility to make tests at the distributing board. In each case

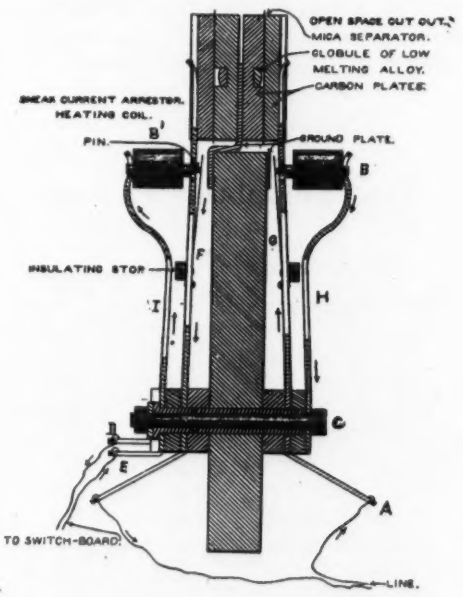


FIG. 9.—DISTRIBUTING BOARD PROTECTOR.

there is supplied a peculiarly formed test block (Fig. 10), which may be at once inserted between line springs, and when in place extends each side of the subscribers' line through a flexible cord to any form of test apparatus that the wire chief may desire to employ.

The distributing boards so far described are usually called *"Main distributing boards,"* because they are used to enable a rearrangement between *all* the cable plant and *all* the switchboard. But in the case of multiple switchboards any set of multiple jack could be associated with any line signal and answering jack, and cases might arise where it would become advisable quickly to change the mutual relations of multiple and answering jack. Hence, it is customary to carry the switchboard cables from the protected side of the main distributing board to the horizontal side of a second distributing board called the *"intermediate distributing board."* The answering jacks are connected to cables which run through the horizontal side of this latter board, while the multiple jacks are carried to the vertical side of this board. Then by means of jumpers any multiple jack can be connected to any answering jack. In many of the modern switchboards more than two wires are

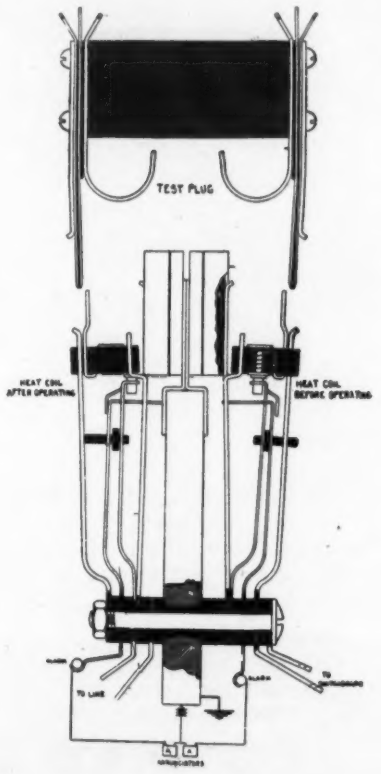


FIG. 10.—DISTRIBUTING BOARD PROTECTOR.

needed for each circuit, hence the distributing board terminal becomes correspondingly complex.

One of the important, oftentimes least understood, and seldom employed functions of the distributing boards, is the opportunity that it offers easily to rearrange and adjust the load on the various operators. Suppose a new office to be opened and a hundred lines placed before each operator. The data available allow of making only the roughest kind of a guess as to the amount of traffic each line will originate. Operator A may get 2,000 messages per day

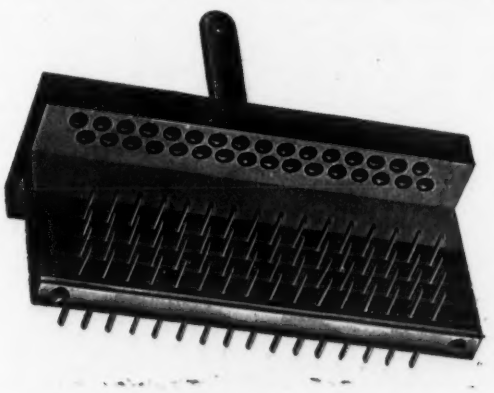


FIG. 11.—DISTRIBUTING BOARD TERMINAL.

and operator B 1,000. A will be overloaded and B underloaded; nothing is more destructive of good service. After a short experience, subscribers can be classified as to the quantity of business they originate, and then by the change of a few jumpers the lines may be reapportioned among the operators in such a manner as to give to each approximately 1,500 messages per day, without any change either in the apparatus or the numbering; in fact, no one but the wire chief and the traffic manager need be aware that a change has occurred. Unfortunately, the adjustment of the load line is a factor in operating to which but scant attention is paid, for, astonishing as it may seem, some large boards are installed without the important feature of an intermediate board.

Electrical Features of the Elks' Carnival at Buffalo.

The entire business part of Buffalo was in gala attire last week in honor of the nineteenth reunion of the Order of Elks. Bunting of many colors—purple, the Elks' color, predominating—was draped everywhere. But if the daylight scene was gorgeous, it was far excelled by the electrical decorations at night. Through the energy and resourcefulness of Mr. Charles R. Huntley, general manager of the Buffalo General Electric Co., the city streets presented a night scene probably never before equalled in similar celebrations. Niagara electric power was freely drawn upon, and was everywhere in evidence through incandescent lamps festooned across the fronts of buildings in "Welcome" signs, and in elaborate special designs embodying the characteristic Elk emblem.

The unique feature of this festival of light was a "Mercury Arc Tower," located in Shelton Square. This was a fluted column of "staff" 75 feet high, studded with 100 mercury arc lamps. Standing alone, this tower produced a most startling effect, due largely to the characteristic greenish light of the mercury arcs. It stood out conspicuously in the mass of many colored incandescents covering the fronts of the buildings on the Square and the radiating streets. The natural curiosity of the people regarding its peculiar color caused a constant dense crowd about its base. Inasmuch as the tower was visible for a long distance up the streets leading from the Square it received a great deal of attention, and was generally spoken of as the most original feature of the Carnival.

The mercury arc lamps were operated in two series of 50 lights each from 4-amp. Brush arc machines located in the Wilkison Street Station of the Buffalo lighting system. As each lamp consumed only

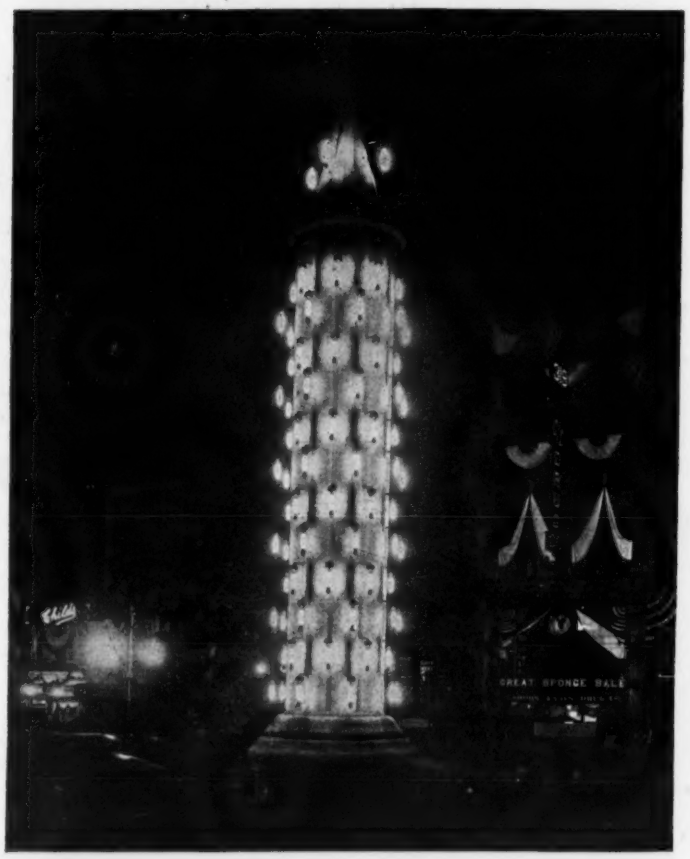


FIG. 1.—MERCURY ARC TOWER.

160 watts, the operating expense was extremely low for so brilliant aspectacle. They were of the standard type for outdoor lighting as developed under the direction of Dr. C. P. Steinmetz, and manufactured by the General Electric Company.

This new use of the mercury arc lamp on a large scale marks a radical step in electric lighting for decorative purposes. The incandescent lamp reached its climax for general illumination and for decorative effects in the work of the late Luther Stieringer at the Pan-American Exposition four years ago in Buffalo, and it is interesting to note that the most recent development in this branch of the art should be successfully tried in the same city, using also Niagara power. This luminous tower was a special contribution to the Carnival by the Niagara Power Company, the Cataract Power & Conduit Company, and the Buffalo General Electric Company. Mr. Huntley conceived the idea, and designs were prepared by the illuminating engineers of the General Electric Company, which furnished the material and superintended the installation.

The most elaborate decorative feature of the Carnival utilizing in-

FIG. 2.—AN ILLUMINATION FEATURE.

candescent lamps was located at the corner of Main and Seneca Streets. This was a regular cobweb of wires studded with various candle-power incandescent lamps, the whole structure being crowned with four massive elk heads facing the different quarters of the globe. It is understood that 4000 lamps were used in this one feature. Many of the business houses of Buffalo employed experts also to decorate the fronts of their buildings, and the results were decidedly pleasing. On account of the Carnival, many stores increased their window lighting, or added new signs which will remain permanently. Thus the celebration not only increased to a very large extent the temporary lighting of the local company, but has added not a little to its permanent load.

New Telephone Patents.

AIR-DAMPED DIAPHRAGM.

All transmitters show a tendency to sing, due to the vibration of the diaphragm in one of its many natural periods. Usually the false vibration has been overcome by the use of cushioned damping springs. These work very well, but Mr. D. A. Reynolds has supplemented them by an air damper. In every transmitter there is an air chamber behind the diaphragm and when this is closed almost all energy given up by the diaphragm as it deflects into the chamber compressing the air, is given back by the elastic air as the diaphragm goes forward. It is Mr. Reynolds' idea to make the chamber small and to perforate it so that the air is pumped in and out through the perforations, absorbing energy from the diaphragm in both strokes. He has made his instrument of the two-diaphragm type with the sound tube leading between them.

STEP-BY-STEP PARTY LINE SYSTEM.

Mr. E. A. Buell has obtained three patents for a selective party line system of the step-by-step type. These he has assigned to the Selective Signal & Telephone Manufacturing Company. One of these patents describes the system, one the subscribers' selective device, and one the means at the central office for sending out the required current impulses.

In each case in setting the selectors and indicators the revolving parts move in opposition to a spring which upon the release restores all parts to normal.

LETTERS TO THE EDITORS.

Scott on Single-Phase Traction.

To the Editors of Electrical World and Engineer:

SIRS:—You published on July 8, a very interesting summary by Mr. Scott of the development of a single-phase traction. His view of the subject is most instructive, but I am disposed to think that he takes a somewhat roseate view, not perhaps of its possibilities, but of its existing status. His concluding theses are rather to be proved than to be regarded as demonstrated already. To begin with, the real sine qua non in heavy and long distance railway service is high voltage current upon the working conductor irrespective of its nature so long as it is available for operating a good traction motor. If continuous current were thus available, as at present it is not, it would serve as well as any other. In view of the Zossen work it must be admitted that polyphase current is thoroughly available for such service, albeit, no one is disposed to deny that single-phase current, other things being equal, would be more convenient, and would generally be preferred. But while most gratifying results have been reached in experiments with heavy single-phase motors, I think that it is hardly safe to say that they yet fulfill the ideal requirements.

I earnestly hope that they will do so when tried out upon a large commercial scale, but all results so far reached must be classified as promising rather than decisive. If engineers all over the world are agreed that one form of motor, namely, the series compensated single-phase motor, is best adapted to meet the demands in heavy railway traction, this cosmopolitan agreement is, for the present, jumping at conclusions. For example, if the vapor converter should finally justify the hopes of its friends and become available in large units, I venture to say that the series compensated single-phase motor would rapidly slide into innocuous desuetude. The direct-current traction motor is by no means dead and buried, nor is the induction motor out of the range of possibility. We must need to remember that in spite of all the work that has been done in electric traction, the heavy railway problem has hardly yet been touched, let alone solved. I hope that Mr. Scott's enthusiasm will prove to be well founded, for complete success would mean a revolution in railroading, but I deprecate the dangers that spring from over confidence in a thing just coming into use. Its real value is often diminished by too fervid expectations, and its deserved progress thus impeded.

BOSTON, MASS. JOHN WHITEHOUSE.

Electrolytic Wave Detectors in Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

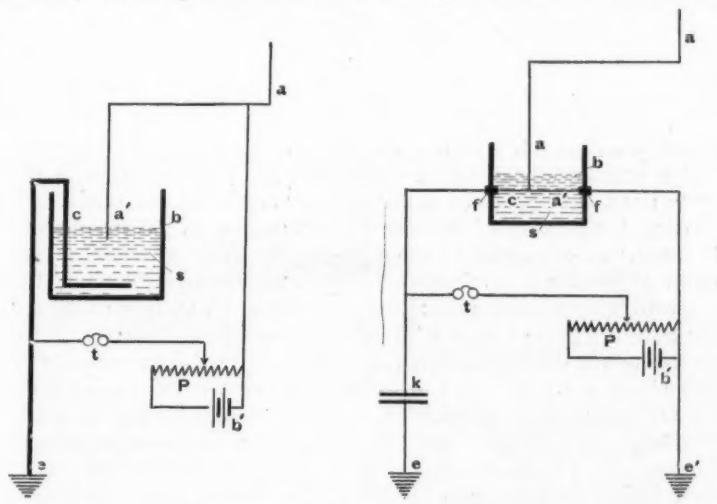
SIRS:—Kindly allow me to present the following data concerning the electrolytic wave detector. Besides the contention for originality, the different claimants disagree as to just how the electrolytic cell acts in performing its work as a wave detector. I believe that I can offer substantial and practical proof on this point. As used by System Telefunken, Fessenden and DeForest, the aerial or antenna is connected to the anode and the ground to the cathode, as shown in Fig. 1. By this arrangement of circuits any action produced by the ethereal wave is over the same identical path as the local action of the cell and might tend to both interrupt the polarization and to heat the solution. As shown in Fig. 2, by bringing the antenna in on a separate and distinct wire from either anode or cathode, we remove the wave path from the path of local action; and the waves can, therefore, no longer interrupt the local action. Yet it has its path to earth through the solution as before and can still continue its heat effects. The result is that no signals are produced, showing conclusively, in my opinion, that the signals must be the result of interruptions in the local action of the cell.

My first use of the electrolytic cell as a wave detector was in May, 1901, being at that time associated with the Inter-Island Wireless Telegraph Service at Honolulu, Hawaii. That company installed the Marconi apparatus in July, 1900, at some seven stations, covering the Hawaiian group.

While setting up and testing the voltage of a number of Bunsen cells at their station at Keomuku, Lanai, in company with Mr. Chris. Wagner, who is now chief operator of the company, we noticed that the galvanometer needle swayed or trembled in unison with the spark from the powerful transmitter at the time in communication with Mahukona, Hawaii, 80 miles distant. The battery was being set up and tested on the front porch of the station and within a few feet of where the antenna entered the building. It was quite puzzling to us at first, but after some investigation the swaying of the needle was attributed to the spark produced within the station.

Some of the carbon and zinc elements having become lost in shipment we were obliged to substitute iron and steel, using strong nitric acid as the sole solution. These latter cells were not a success in connection with the others of the battery; but we noticed that when connected to a galvanometer they were more visibly affected by the spark than had been the regular cell. Efforts were made to receive signals from a distant station by means of the cell, but without any success whatever. It could not have been very sensitive to weak signals coming from a distant station, owing to its crude construction and the fact of depending upon the eye to detect any motion of the galvanometer needle. Then, again, the distant stations were probably not able to send with much strength as they had, like ourselves, been complaining of weak battery and were awaiting their supply of Bunsen cells.

I was soon transferred to the Lahaina, Maui, station, 9 miles distant from Lanai, and thought no more of "our new system" until one day receiving a letter from Mr. Wagner that he had had no



FIGS. 1 AND 2.—ELECTROLYTIC WAVE DETECTORS.

a = antenna.
a′ = anode.
c = cathode.
s = acid solution.
t = telephone receivers.
p = potentiometer.
b′ = battery.
b = glass cup.
e and e′ = earth.
k = condenser.

The anode and cathode are sealed in the glass cup at points *f* (Fig. 2); *k* is a small condenser to prevent short circuit of battery.

further success with the cell even after Mahukona had installed their new battery. He suggested that I try the "wet coherer," as he termed it, at the Lahaina station. Lahaina being but a branch station from the main line, had required no renewal of her original battery of dry cells (O'Bach's) as installed by the Marconi people, and consequently there were no electrolytic cells at hand. This, together with the fact that the Marconi apparatus received perfectly and that I was just nine miles of rough channel, crossed only by Kanaka hollow log canoe from Lanai, the nearest available supply of "wet coherers," caused me to forget the whole matter. In June, 1902, while assisting in the installation of the wireless stations at San Pedro and Avalon, Cal., I was again struck with the idea of trying the "acid coherer," by which name it had then become known. My efforts were not rewarded with success. Since then I have given it a thorough test and find it is a fairly reliable apparatus and capable of great speed, in the latter respect far more rapid than the filings coherer systems. I have no opportunity to try the electrolytic receiver on extremely long range, but I am of the opinion that it is very sensitive and capable of long range. The plan of connections as shown in Fig. 2 can be advantageously employed on every form of wave detector, being especially meritorious with the carbon and steel microphone and the filings coherer. A Slaby multiplying coil should be used in connection with the carbon and steel microphone. I have chosen to call this plan of wiring "Cole's plan," for it was Mr. R. T. Cole, of the U. S. Navy, who first used it, to the best of my knowledge and belief.

SAN FRANCISCO, CAL. W. R. CARROLL.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Starting up Induction Motors.—LEWIS.—An article discussing what he calls the "selective winding" method of starting induction motors. The first machine of this kind was designed by Bradley, who used two separate rotors in one machine. The next type was that of Deri, whose rotor winding is shown in Fig. 1, where *a* represents

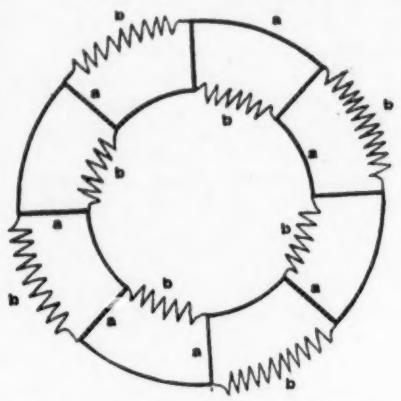


FIG. 1.—STARTING INDUCTION MOTORS.

a low-resistance conductor, the ends of which are joined together; and *b* consists of high-resistance connecting pieces. There is the same number of poles on the rotor winding as on the stator. At starting, the number of poles on the stator on each phase is halved by means of a change in the connections. This change has the effect of making the voltages on all the conductors of each of the rotor windings, when added together, produce no pressure, taking the sign and phase into consideration. The current, however, has a path through the high-resistance connections, and each winding is virtually a squirrel cage one, with only two conductors per pole. At full speed, when the machine has the ordinary number of poles, the motor works in the ordinary manner, only a small current passing through the high-resistance connections. This machine was later modified in some respects by Deri. The author then describes a selective winding of his own, which is constructed, for example, in an eight-pole machine, as follows: If with a direct current passed through the winding of one phase the polarity at running were N. S. N. S. N. S. N. S., then at starting the connections would be changed to make the polarity N. S. N. S. S. N. S. N. The voltage on a wave-wound rotor, when each phase of the stator is fed with current with the connections as described, will now oppose one another. Above the wave winding a high-resistance squirrel-cage winding is provided. The machine at starting will be exactly the same as if two portions of the stator at the two opposite points where the current is reversed were not wound; the extent of the portion unwound is the pitch of one pole at each point of opposition. The angular velocity of the rotating field is the same whether the stator is connected for starting or for running. As two poles in this type of machine are always neutralized, and as these two poles are a source of magnetic leakage which lowers the power factor and therefore the starting torque, the greater the number of poles the less is this leakage in proportion. He uses a type of stator which makes this leakage as small as possible.—Lond. *Elec. Rev.*, June 30.

Separating Losses in Direct-Current Machines.—LINKE.—An article illustrated by diagrams on the separation of the losses in direct-current machines by the well-known method in which the machine is run as a motor, the supply current is broken and the decrease of speed is determined as a function of the time. The author discusses especially methods to be applied when the speed decreases to zero in a very short time.—*Elek. Zeit.*, June 29.

Diseases of Electric Machinery.—CROCKER AND WHEELER.—The final instalment in the series of articles on the diseases of electrical machinery, their causes, symptoms and remedies.—*Am. Elec.*, July.

Armature Windings of Alternators.—NEWBURY.—A continuation of his serial illustrated by diagrams. In the present instalment he discusses two-phase, open-type windings.—*Elec. Jour.*, July.

Compressed Gases for Transformer Insulation.—See the abstract under "Electrophysics."

POWER.

Individual Versus Belt Drive in Electrically Operated Shops.—BATES.—An illustrated article in which the advantages of individual electric drive are pointed out. In a number of establishments where this means of driving machinery has been adopted, it has been demonstrated that the first cost of the motors and their controllers is not greater than the equivalent shafting, hangers and other paraphernalia required with belt driving, so that the installation of anything but individual electric drive, except possibly in some instances where peculiarly special conditions prevail, indicates a lack of familiarity with the full advantages which are to be derived from this method. The writer draws attention to the lack of consideration which is usually given to the question of the correct size and type of motor, the equipment being either too large and costly or too small for the work. He cites the case of a boiler shop in which the machines are driven through shafting and belting by a 25-hp motor. The average consumption is 5.4 kw, while the power which is continually consumed in driving the belting and shafting is 4.4 kw. This represents a yearly waste of $660 with power at 5 cents per kw-hour. The introduction, he says, of electric apparatus in the equipment of shops without fully knowing the reason for doing so is probably the explanation for the easily avoidable mistakes found in many electrically equipped shops.—*Am. Elec.*, July.

Variable Load Loss.—ASHE.—If the load in a transmission line varies, the line loss also varies. The author defines the "cost factor" as the ratio of actual line loss to the ideal line loss which would occur with steady load in place of the variable load. The cost factor equals the mean square current divided by the square of the average current. In two cases taken from actual practice it was found to be 1.29 and 1.22, respectively.—*Eng'ing News*, July 13.

Careless Handling of Direct-Current Motors.—VIALL.—A short article on the proper handling of direct-current motors. The author cites a case in which the printed instructions given out by a central station for the purpose of guiding those whose duty it might be to start and stop any of the motors owned by the company and rented to its customers, would, if followed, result in the destruction of the motor.—*Am. Elec.*, July.

Horse-Power Value of Streams.—CHURCH.—A mathematical paper in which the author gives some condensed formulas for the rapid estimate of the discharge value of a given drainage area, and illustrates and simplifies the method of computation of the value of the drainage area in connection with partial storage and steam auxiliary.—*Eng'ing Record*, July 1.

City Refuse as Fuel.—WALSH.—An article showing how city garbage and refuse is utilized to generate electricity in many English cities. In nearly all of these, however, the refuse is not sufficient in calorific value, so that the addition of coal is necessary. The actual destroying capacity of the destructors in operation in England with which electrical generating plants are combined averages nearly 2,000 tons of refuse daily.—*Am. Elec.*, July.

TRACTION.

Single-Phase Traction.—SCOTT.—A general discussion giving historical notes on the development of the single-phase railway system, which was referred to editorially in our issue of last week. The use of single-phase current is considered essential for heavy and long-distance railway service. "The verdict of American engineers may be safely taken to be that the compensated series type of motor first used by the Westinghouse Company and finally taken up by the General Electric Company is the one best suited for railway work. Various types have been employed by foreign manufacturers, but there is apparently a strong leaning toward the type which has been adopted in America."—*Elec. Jour.*, July.

Single-Phase Traction in Paris.—GRATZMULLER.—An illustrated article on single-phase series motors of the Latour type, made by the French Thomson-Houston Company. The present author is the designer of these motors. Crane motors from 3 to 20 kw, with a

frequency of 42 periods, have proven satisfactory in every respect for a year. Motors for frequencies of 77, 60, 50 and 42 have been used for elevators and machine tools during the last 10 months. The author discusses the trial made on a tramway line in Paris which was already dealt with in the Digest last week. He gives the principles of the series motor, the repulsion motor and the compensated series motor which is a combination of the two. He then gives the following data on the traction trial. Single-phase alternating current of 25 periods at 500 volts is used. The two four-pole traction motors give each 37 kw at 300 volts; the increase of temperature of the commutator is 75° C. after an hour of operation, while the other points did not increase in temperature by more than 60°. The efficiency is 84 per cent. The air-gap is 2 mm. and the speed reduction by gearing is from 4.6 to 1. A transformer on the car reduces the voltage from 500 to 300 or less. While it would have been possible to use an auto-transformer, it has been thought preferable to use a double-winding transformer in order to use as much as possible the same equipment as will be required in high-voltage cars. (The government regulations do not permit the use of a higher voltage within the city limits.) "The tests have shown that the air-gap may be enlarged without inconvenience and that the motors can easily be started with a torque three times the normal value. The motors weigh 1,350 kg. and the transformer 1,100 kg.; the latter is, however, far too large." The wiring sketch of car and controller was given in the Digest last week.—*L'Industrie Elec.*, June 25.

Electric Traction in Germany.—HAAS.—A paper read before the German Association of Electrical Engineers. The author first sketches the development of electric traction in Germany. Up to the end of 1903 the total length of track was 3,300 miles and the number of motor cars 9,100. The total cost of installation of the electric roads is estimated at about $210,000,000. There are on the whole 174 companies with about 42,000 officials and workingmen. On an average every inhabitant of Germany makes 25 trips on an electric road per year. The total receipts of German electric roads during this year was $37,500,000. All cities with more than 40,000 inhabitants have electric tramways, and it is thought that for smaller cities the installation of electric tramways would generally not pay. Further development of electric traction in cities, therefore, depends on the increase of population or the extension of suburbs. Light suburban electric railways have not proven profitable in Germany compared with Belgium. There are in western Germany only one-fifth as many light railways in the same area as in Belgium, and while in Belgium all the light railways are profitable, they are not so in Germany. It is pointed out that there is in Belgium one official department which governs all light railways, and it is thought that this has done much to make them profitable. The author then speaks of "heavy traction." He first refers to city and suburban roads, for which direct current with the third-rail or single-phase, alternating current with a trolley system are thought to be advisable. The latter system will be used on the city and suburban railways in Hamburg. He then refers to high-speed traction proper, and points out the great commercial advantages of high-speed service between two large cities like Berlin and Hamburg, which would thus become sister cities. A man may read and answer his mail in Hamburg in the morning, take a train to Berlin, go to the Stock Exchange and attend to his business, and may be back in Hamburg in the evening. For such railroads the problem of acceleration is of no account whatever. The three-phase system would have the disadvantages of three overhead wires, so that the single-phase system seems preferable. He points out that the essential superiority of the electric system over the steam locomotive is due to the fact that the electric train does not generate its own energy, but gets it from a central station which, if properly dimensioned, represents an inexhaustible reservoir of power. Further development of interurban roads between important cities is expected. For this purpose either the direct-current system or the single-phase, alternating-current system, or the use of both together (with direct current in the cities and single-phase current outside) will be used. On ordinary railways very little has been done so far to introduce electric traction. If there is no large traffic the cost of the overhead construction and of the electric generation of energy will render the service expensive. In Sweden and Norway, where proper fuel for the locomotive is not available, while there are abundant water powers, the problem of introducing electric traction on the main railroads is now being carefully studied by the government.—*Elek. Zeit.*, June 20.

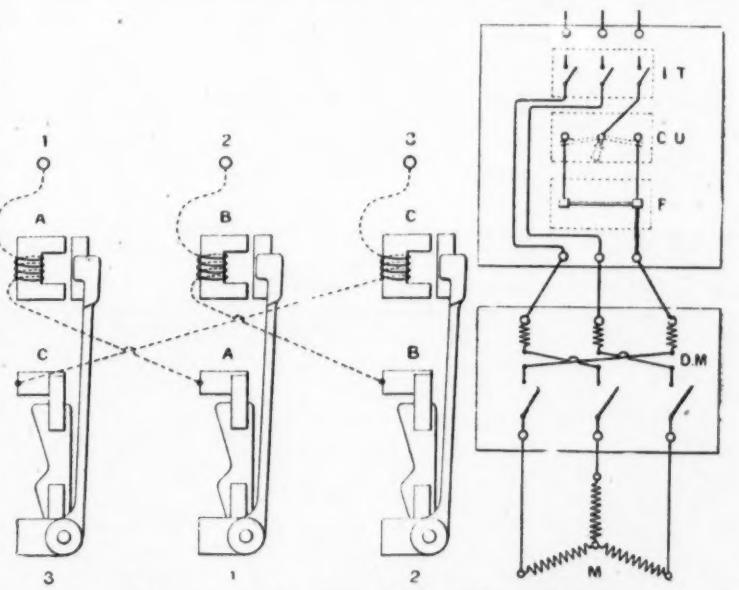
Fields Versus Armatures Nearest Trolley.—ANDREWS.—It has become standard practice in railway motor work to place the armature in circuit nearer the trolley side of the line and the fields nearest the ground side. The author shows that the most important reason for this method of connection is due to the behavior of the motor when a brush holder or the armature becomes grounded. Otherwise it would probably be better to connect the motor with the fields in the circuit nearer the trolley.—*St. R'y Jour.*, July 1.

Portable Sub-Station.—HEWETT.—An illustrated description of a portable sub-station used by the Cincinnati & Columbus Traction Company. It is placed in a standard freight car, which can be hauled about to any point on the line where extra power is needed. The author describes the electric equipment of the car in detail and explains the changes made to adapt the apparatus for operation under the unusual conditions.—*St. R'y Jour.*, July 8.

Railway Braking.—DAWSON.—Conclusion of his illustrated serial in which the author discusses automatic pressure governors.—*Elec. Jour.*, July, 1905.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Three-Phase Circuit-Breaker.—An illustrated description of a circuit-breaker for the protection of a three-phase motor, devised by Choulet and built by a French company. It consists of three circuit-breakers as shown in Fig. 2 and connected in such a way



FIGS. 2 AND 3.—THREE-PHASE CIRCUIT-BREAKER.

that when the current fails in coil *A* then the current in coil *C* is automatically broken so that when there is an accident on one line the three interrupters act automatically in succession. By using this circuit-breaker in connection with a fuse, as shown in Fig. 3, the combination acts in any of the following four cases: accidental failure of the current in the three wires; accidental failure of the current in one of the three wires; dangerous drop of voltage at the motor terminals; overloading of the motor. In Fig. 3 *I T* is a three-pole switch, *C U* a unipolar, double-throw switch (presumably intended to be used, when it is desired to immediately restart the motor, after the fuse has blown and the circuit-breaker has acted; it is then possible to start again at once without first replacing the fuse); *F* is the fuse; *D M* is the underload circuit-breaker; *M* the motor.—*L'Industrie Elec.*, June 25.

Starting Rotary Converters.—WAGNER.—An article illustrated by diagrams showing in detail all the steps in starting rotary converters in the following three cases. The first case is that of one three-phase rotary converter operating from alternating to two-wire, direct current. The machine is started by a separate starting motor and a synchronizing rheostat. The second case is that of one three-phase rotary converter operating from alternating to two-wire, direct current. The machine is started from the direct-current side as a shunt motor. The third case is that of one two-phase rotary converter operating from alternating to two-wire, direct current. The machine is started with a separate starting motor and a synchronizing rheostat.—*Elec. Jour.*, July, 1905.

ELECTROPHYSICS AND MAGNETISM.

Compressed Gas as an Insulator.—RYAN.—An illustrated account of experimental investigations on the variation of the dielectric strength of gases with varying pressure. Up to pressures of ten to twelve atmospheres the dielectric strength of air varies directly as the density, i. e., directly as the volume and absolute pressure and inversely as the absolute temperature. The rupturing voltage for any given density and distance between terminals, is distinctly affected by the proximity of electrostatic flux-carrying bodies. The material of which the terminals are made has little or no effect upon the rupturing voltage for given conditions. At atmospheric pressure, the rupturing voltage does not vary directly with the distance between terminals, being proportionally higher for shorter distances. Fig. 4 shows the change of the dielectric strength of carbon dioxide with increasing pressure. It has been suggested to

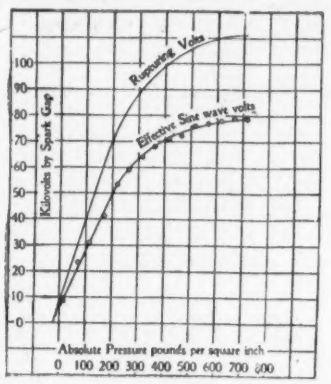


FIG. 4.—CURVES OF DIELECTRIC STRENGTH.

use compressed gas for the insulation of underground cables. Experiments have also been made to determine the possibility of using compressed gas as transformer insulation. It has distinct advantages over oil, and it would seem that carbon dioxide or air are about of the same usefulness. However, there are the following disadvantages: Difficulty will be encountered in bringing leads from the case and in keeping the case tight, while the cooling facilities will be poorer. Further, the gas in no way tends to smother an arc once formed as oil does. This has been proved experimentally. In the use of air there is also danger from possible explosions, which the use of an inert gas like CO_2 will avert. The explosions, in air at a pressure of 200 pounds, of volatile matter which might be distilled from the necessary solid insulation of the transformer winding, is a feature well worth examining. It is probable that compressed gas will not prove a formidable rival of oil in the construction of the ordinary transformer, and that any field it may have will be limited to those cases where the essential requirement is enormous insulating strength, for the sake of which, it may be found profitable to overcome the accompanying obstacles.—*Elec. Jour.*, July.

Magnetic Properties of Pyrrhotine.—An account of measurements showed a remarkable dissymmetry in the magnetic structure of pyrrhotine. It is practically ferromagnetic in the magnetic plane and only paramagnetic normal to that plane. The author studied this property by means of a new torsional method, and found that the atomic susceptibility of the iron in pyrrhotine, measured normally to the magnetic plane previously discovered by the author, is very nearly equal to the atomic susceptibility of iron in other paramagnetic compounds.—Lond. *Elec.*, June 30; from *Comptes Rendus*, June 13.

Stationary Electric Oscillations.—GRIMSEHL.—An account of experiments in which he used a modification of the Arons tube in order to make stationary electric oscillations visible. In the Arons tube, two parallel wires are mounted in the interior of an exhausted glass tube. In the author's new form, narrow strips of tin foil are stuck along the outside of the tube, and are connected with the exciter at one end. As in the Arons tube, the gas shines out at the points where high differences of potential exist. The bridges are made of bent copper wires, pressing elastically against the tin foil strips. The latter are easily shortened, and may be lengthened by sticking on further strips. Thus it is possible to get accurate tuning. Several tubes may be placed in series and connected by short wires. For some experiments the author uses serpentine tubes.—Lond. *Elec.*, June 30; from *Phys. Zeit.*, June 15.

ELECTROCHEMISTRY AND BATTERIES.

Cyanide Process for Gold Production.—DAVIS.—A very full discussion of the development and present status of cyanidation in the United States. After some introductory remarks on the history of the process, the subject is discussed under the following headings: Crushing, alkalinity, selection of alkali, treatment of coarse sands, slimes treatment, treatment of high grade ores, precipitation, clean-up and refining. The article is concluded by an interesting discussion of the possibility of regenerating the alkaline cyanides from the double salts. This problem was once considered to be a momentous question, since when solved it would make possible the treatment of all ores by the cyanide process. There are now two known solutions of the problem. But while it has been found in practice that a material saving is accomplished in the cyanide consumption, yet it has also been realized that the value of regeneration was overestimated and that by regeneration the treatment of all ores has not been made possible. These two methods are those by Orr and by Davis. The latter uses a peculiar method of alternating-current electrolysis. It has been used successfully on a commercial scale for some six months, but the theory of the process is not yet understood.—*Electrochem. and Met. Ind.*, July.

Concentration Cells.—CADY.—An account of an experimental investigation in which the author studied concentration cells with liquid ammonia as solvent. From the striking similarity in the behavior of aqueous and ammonia solutions, so far as investigated, it was expected that the laws that hold in water solutions would also apply to ammonia solutions. This was indeed found to be the case.—*Jour. Phys. Chemistry*, June.

Lead Soldering.—SCHOOP.—An illustrated discussion of those methods of antozenous lead soldering, which are of special value for storage battery factories. The first method is the air-hydrogen flame; the hydrogen is either producted from zinc and sulphuric acid, or is taken from steel bottles, in which the hydrogen is compressed up to 125 atmospheres. The second method is the oxy-hydrogen flame; both gases are obtained by electrolytic decomposition of water, and are used in the factory at a pressure of 500 to 600 mm. water column, while for installing batteries outside the factory, the gases are compressed in steel bottles. The author points out the inherent advantages of this method. The third method is the oxygen-illuminating gas flame; according to the circumstances this method may often be used in factories as a substitute for the second method, although the heat of the flame is considerably less. The fourth method is electric welding, which has developed and is in use especially in French storage battery factories; it may be learned by unskilled workingmen in one or two days, while the use of the air-hydrogen flame or of the oxy-hydrogen flame requires considerable experience. Two types of burners, suitable for either the oxy-hydrogen or the air-hydrogen flame are described and illustrated.—*Electrochem. and Met. Ind.*, July.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring Capacity of Cables.—DEVAUX-CHARBONNEL.—A description of a new method for measuring the capacity of submarine cables. The author claims that it gives more accurate results than the methods generally employed, and is simple in theory and working. It consists essentially in charging at the same time as the cable a condenser of known capacity connected in series. The capacity of the cable is deduced from the charge taken up by the condenser. If C is the capacity of the condenser and X that of the cable, E the potential of the battery and V that of the common coating, then, if the charges taken up are equal, we have

$$C\ (E - V) = XV.$$

If the condenser is detached and the coating at potential V is earthed, it will take up an additional charge, $Q_1 = CV$, measured by a ballistic galvanometer. With the battery only, the condenser takes a charge $Q_2 = CE$, and the capacity of the cable is given by

$$X = C\,\frac{Q_2 - Q_1}{Q_1}.$$

The author found in the Brest-Dakar cable a capacity always confined between 1,085.8 and 1,087.4. Earth currents and residual charges are eliminated. A serious fault in the insulation does not sensibly affect the result. The author has found that the capacities of cables increase 0.3 to 0.4 per cent. after laying, probably owing to the enor-

mous pressure on the insulation.—Lond. *Elec.*, June 30; from *Comptes Rendus*, June 13.

New Platinum Contact.—GILDEMEISTER AND WEISS.—In physiological experiments with short electric currents it is usual to employ a Helmholtz pendulum for breaking the circuit. It is desirable to use the same means for closing it, but it is much more difficult to obtain an instantaneous make than an instantaneous break, since the terminals suddenly thrown into contact are liable to vibrate and lead to several breaks before the circuit is finally closed. The present authors have worked out a successful contact, which, with care, works accurately to within one-millionth of a second. It is an improved form of that devised by Edelmann, and consists of a lever, *b* (see Fig. 5), which is hit vertically by the arm of the pendulum advancing in the direction of the arrow. This releases the contact screw *m* and breaks the circuit. After a short interval, the stay *n* is withdrawn from the lever *p*, and the spring *s* draws it into contact with *q*, thereby closing the circuit. By gradually reducing the interval the authors obtained a zero point, and judged by its steadiness whether there was any vibration. Finding that there was, they covered the spring *s* with thin rubber tubing, stuck a steel pencil on the lever *p* with wax and wound it with iron wire. This damped the oscillations effectively. The contact sounds "leaden" if it is good.—Lond. *Elec.*, June 30; from *Ann. der Physik.*, No. 6.

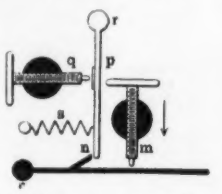


FIG. 5.—PLATINUM CONTACT.

Comparison of the Mutual Induction of a Pair of Coils with the Self-Inductance of One of Them.—HERDEGAN.—An abstract of a paper presented at the Chicago meeting of the American Physical Society. Maxwell's method is modified so as to permit the use of the differential transformer as a measuring instrument. The balance condition being equality of amplitude and phase of the two currents in the differential transformer simplifies the expression for the ratio of L to M. The sharpness of the balance makes it possible to determine this ratio to an accuracy of one-tenth of one per cent for a single observation.—*Phys. Review*, July.

BOOK REVIEW.

LE TURBINE. (Steam Turbines.) By Giuseppe Belluzzo. Milan: Ulrico Hoepli. 413 pages, 300 illustrations.

The steam turbine has so recently sprung into active service on a large scale that there has been but little opportunity to develop its engineering theory. This volume is one of the most complete textbooks on the steam turbine that has yet appeared in the Italian language. It employs principally graphic methods in its theoretical treatment.

The book is divided into four sections. The first deals with the elementary principles of the subject. The second applies graphic methods to the quantitative properties of steam and gas turbines. The third treats of the various forms of turbine in practical use and compares their properties. The fourth deals with the use of the steam turbine in marine service. The types of turbine described are those of De Laval, Seger, Riedler-Stumf, Rateau-Elektra, Zoelly and Curtis.

The book is excellently illustrated and clearly written. It will be of great interest to students of engineering acquainted with the Italian language.

Opening of the International Electrical Exhibition at Boston.

THE International Electrical Exhibition, held in connection with the convention of the National Electrical Contractors Association, was opened at Mechanics Hall, Boston, Saturday evening, July 15. About 3,000 persons were present, and from the electrical standpoint it is safe to say that no exhibition of recent years in Boston has presented so many features of interest. The entire street floor of the building and part of the basement were devoted to attractive displays, and the halls and booths were tastefully decorated with the national colors in flags and bunting. The widespread use of decorative lamps added brilliancy to the scene.

FIG. 1.—GENERAL VIEW OF MAIN HALL.

The entire platform at the west end of the main hall was occupied

by the Westinghouse Electric & Manufacturing Company. Over the center of the exhibit was a large high-potential electric sign bearing the word "Westinghouse" in porcelain letters on a dark background. The letters were backed with tin-foil, and alternating discharges at 30,000 volts between the backs produced striking effects. Various types of Sawyer-Man lamps were displayed in a glass case on the platform, including colored, pear-shaped and circular bulbs, frosted and plain types, silvered reflectors, etc., from 4 cp to 50 cp. Along the front of the platform vertical standards carried a fine display of Nernst lamps, consisting of the single-glower, 50-cp, the double-glower, 100-cp and the triple-glower, 170-cp types. A 42-in. Stafford fine yarn cotton loom was shown in full operation, being geardriven by a ½-hp, three-phase, 200-volt, 25-cycle induction motor with automatic stopping devices actuated by the breaking of a thread in the weaving process or other mishaps in the loom proper. Another prominent exhibit of this company was composed of a large table of central station and portable testing instruments. These included a portable polyphase wattmeter, portable series transformer adjustable from 10 to 50 amp., an alternating-current ammeter adjustable from 5 to 10 amp., which can be used with the preceding instrument to cover a scale range of 5 to 50 amp., always working at the accurate points of the scale; a portable voltage transformer, portable precision voltmeter and a portable indicating wattmeter independent of power factor effects. A single-phase synchroscope was shown, also a frequency meter, series incandescent shunt coil and a prepayment wattmeter with a capacity of $2.50 in quarters. Four Cooper Hewitt mercury-vapor lamps were exhibited, and a prominent place was occupied by a 50-lamp arc circuit regulator with a new woven-wire screen for coil protection. An alternating-current arc switchboard panel with an oil switch was shown, together with a 50-kw, 25 or 60-cycle oil-insulated, self-cooling transformer for the high-potential sign mentioned above. Fuses of the enclosed type were shown, ranging from 250 to 20,000 volts in potential rating and up to 400 amp. at 1,500 volts in capacity. Series and multiple arc lamps for direct and alternating circuits were displayed, together with a high-tension oil switch for pole service up to 6,600 volts, fan motors and a 5-hp single-phase, 110-volt, 60-cycle induction motor with automatic centrifugal clutch for taking up the load. In the audience room on the second floor a biograph exhibition comprising a trip through the Westinghouse factory at East Pittsburg was given nightly to interested audiences.

The General Electric Company exhibited in its space in the main hall an interesting group of apparatus. Foremost came the new 2.5-watt incandescent lamp of the company, called "a high-efficiency lighting unit," fitted with a metallized carbon filament. Sixteen of these lamps in the 50-cp, 110-volt size were hung in a square above the easterly group of palms and floral pieces which attractively surrounded the exhibit space, current being supplied by a 30-amp. mercury arc rectifier mounted on a switchboard panel in the middle of the floor. The rectifier received 220-volt, single-phase, alternating current and supplied the lamps with 110 volts direct current. The 2.5-watt lamps were shown in operation and separately on tables in the 50-cp and 100-cp sizes with frosted bulbs and both concentrating and diffusing Holophane reflectors. At the west end of the exhibit the 100-cp size was shown in operation, surrounding a large enclosure. Half a dozen 1905 fan motors were shown and several small alternating-current and direct-current motors for automobile and general power service were displayed, together with a 1-kw motor-generator set, 500 to 10 volts for storage battery charging. Two biographs of electric locomotives and trains were in frequent operation.

An operating exhibit of the Gray National Telautograph Company, of Boston, was shown in the main hall. Two stations were fitted up with improved equipment noticeably more compact than the earlier types of apparatus displayed by the company.

Two wireless telegraph stations were fitted up in the hall by the Marconi Wireless Telegraph Company for the transmission of messages, and many visitors availed themselves of the privilege. The messages were automatically printed in the Continental Morse code on a paper strip and given away as souvenirs.

Pass & Seymour, Inc., of Solvay, N. Y., displayed a large number of specialties in the way of double-pole brass sockets, wall sockets, attachment plugs, porcelain cleats, wiring tubes, primary cut-outs, all styles of regular and special equipment for wood and metal signs, and temporary cut-outs.

The Couch & Seeley Co., of Boston, showed a complete line of telephones and supplies, including central energy and magneto switchboards for central offices and private branch exchanges, interior and intercommunicating systems of the non-interfering and common return types, portable street railway and linemen's sets.

Inter-pole motors received attention at the hands of the Electro-

FIG. 2.—COUCH & SEELEY CO.'S EXHIBIT.

Dynamic Company, of Bayonne, N. J. A working exhibit with a 4 to 1 speed variation was shown by belting a 5-hp motor to a generator which could be loaded up to 100 per cent overload on the motor. An ammeter of large size and a similar speed-calibrated voltmeter were mounted prominently to show the speed and load changes. Reversals were also made to show the absence of sparking under severe conditions of service.

G. M. Gest, conduit expert, of New York, exhibited a large number of photographs showing construction work performed by him in different cities of the United States, also in Montreal, Toronto and Mexico City.

Trolley maps, the "Trolley Wayfinder," timetables, information and guides were supplied from a booth occupied by the New England Street Railway Club's "Bulletin."

The Bryant Electric Co., of Bridgeport, Conn., and the Perkins Electric Switch Manufacturing Company, of that city, had a main exhibit installed artistically on the sides and ends of an A-shaped wooden tent 14 ft. high and 12 ft. long; 9,000 screws were used in installing the switches, cut-outs, fuses, sockets, bases, etc., which made up this exhibit. Prominent in the exhibit was the Perkins push button switch, designed for easy connection and alignment,

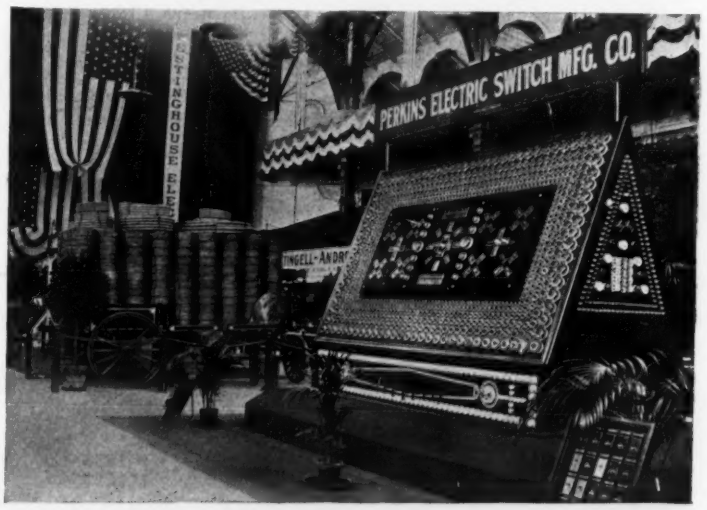


FIG. 3.—EXHIBITS OF AMERICAN CIRCULAR LOOM CO. AND PERKINS ELECTRIC SWITCH MFG. CO.

and built in sizes up to 250-volt rating for incandescent and power service. The Perkins panel switch was also shown, built with all its terminals concealed, with two double-pole switches for two and three-wire service, indicating features, porcelain bases, covers, keys and with plug fuse cut-outs. These switches are especially adapted to grouping. A full line of Bryant enclosed fuses was shown, 250 to 1,500 volts and 400 amp. maximum capacity at the latter potential.

Two large wagon loads of equipment were shown by the American

Circular Loom Company, of Chelsea, Mass. One of these contained 75,000 ft. of circular loom conduit varying in internal diameter from ¼ in. to 2½ in., and the other six tons of "electro duct" enameled conduit and fittings varying from ½ in. to 4 in. in diameter. Various sizes of circular loom conduit were also shown in a circular design mounted on a large standard.

The contract department of the Edison Electric Illuminating Company, of Boston, had an attractive exhibit space, showing photographs of the company's power stations and inviting visitors to their permanent exhibition of electrical appliances at Head Place, Boston.

The Chase-Shawmut Company, of Boston, displayed a complete line of rail bonds, outlet bushings, enclosed fuses up to 600 amp. capacity, open fuses and porcelain fittings.

The Ridgway Dynamo & Engine Company, of 53 State Street, Boston, and Ridgway, Pa., exhibited a 6-hp, 250-volt motor with a 6 to 1 speed variation, 300 to 1,800 r.p.m. Of these machines 3,215 have been placed in service, averaging 16¼ hp each. The company also showed a compact direct-connected, engine-driven. 25-kw, direct-current generating set for general lighting and power service. The engine was of the 9-in. by 10-in. size, making 325 r.p.m., with a guaranteed regulation of 1 per cent. The cross-head shoes are designed so that lost motion can readily be taken up.

A large assortment of enclosed fuses, varying from .3 amp. to 600 amp., and up to 6,000 volts, was shown by the D. & W. Fuse Company, of Providence, R. I. Substantially designed cast-iron service switch boxes were also displayed. This company also displayed field coils made of Deltabeston wire, in all stages of construction. Among the special coils exhibited were: One from a railway motor in which the outer cotton insulation had been roasted off, while the asbestos wire covering had remained uninjured, leaving the coil suitable for rewinding; and another which had been kept at 900° F. for 97 hours and then showing over 400 megohms insulation resistance after being immersed in water. Comparative tests of cotton-covered and Deltabeston wire for charring and red heat were made in the exhibit.

Armature varnishes, P. & B. tapes and insulating paints were shown by the Standard Paint Company, of New York.

The Okonite Company, Limited, showed a large assortment of wire and tape, a large rubber biscuit cut in half to exhibit the inside of fine rubber and a submarine cable which had been tied in hard knots by a tub boat anchor. The Osburn Flexible Conduit Company, of New York, exhibited 40,000 ft. of ¼-in. to 1½-in. conduit, laying special stress upon the toughness, flexibility and interweaving of the component parts. Associated with these three latter companies the Pettingell-Andrews Company, of Boston, exhibited Peerless electric fans, supplies, a 20-cp, 110-volt, 2-watt tantalum lamp in operation and also an alcove space showing illuminated gas and electric fixtures, fancy shades and patterns, mosaic glassware, etc.

A large assortment of heating appliances was displayed by the Simplex Electric Heating Company, of Boston. These included, in part, electric flatirons varying from a 3-pound traveling iron to a 25-pound goose iron, with and without automatic handles and stand switches. Domestic heaters, milk warmers and traveling cups, coffee percolaters, small kitchen stoves, broilers, griddles, a waffle iron, plate warmer, ovens, radiators, glue pots, soldering irons, treeing iron, curling iron and grease paint theatrical heaters, instrument sterilizer and heating pads were also shown. The Simplex Electrical Company, of Boston, exhibited in the same booth armored and lead-covered aerial and submarine cables for general signaling and power work.

The R. M. Cornwell Co., of Syracuse, N. Y., showed universal switch boxes, the "Wonder alternator," weighing 4½ pounds, height 4½ in., length of shaft 6¼ in., output 12 watts, and the "Wonder" dynamo-motor, weighing 4 pounds. There was also exhibited a 3-hp, two-cylinder gasoline engine and a 1½-hp single-cylinder engine.

The Condit Electrical Manufacturing Company, of Boston, exhibited a three-panel Alberene stone switchboard equipped with automatic and non-automatic oil switches, laminated circuit-breakers for alternating-current and direct-current capacities up to 3,000 amp. at 500 volts, an electrical remote control oil switch, knife type of circuit-breakers and samples of "loricated armorduct" from ½ in. to 4½ in. diameter.

A number of specialties were shown by the American Electric Novelty Company, of New York. Among these were the "Noscru" type of screwless push button for street car and telephone or other similar work, the "Ever-Ready Cigar Lighter," aluminum two-light reflectors for incandescent lamp candle-power increase, the "Ever-Ready" keyless clocks and dry battery, flash lamps, miniature lamps, pocket ammeters and surgical lamps.

The Wireless Electric Railway Company, of Philadelphia, showed a model car in operation on a narrow-gauge track with contact buttons in the center, between the rails. The car shoe spans 1½ buttons, which are alive only when the car is directly above, the current being thrown on by an electromagnet in the car which operates a loose armature switch in the button beneath. The wireless electric battery was also shown in this exhibit.

The Bossert Electrical Construction Company, of Utica, N. Y., exhibited outlet boxes, "New Imperial" switches, made up of single pieces of flat copper with no solder or broken contacts, "Monitor" bushings, Erickson insulators and bushings for Greenfield flexible conduit and Sprague armored conduit.

The Electric Gas Lighting Company, of Boston, exhibited an automatic interior system for house or desk installation in which the calling plug releases automatically when the receiver is returned to its hook after a conversation is finished. But one button is required to be pushed in ringing and talking. This is a new feature in a metallic system and was shown for the first time. This company also exhibited for the first time its "Rotokoll" central energy switchboard with 300 lines, all accessible from one position. Each drop occupies no more vertical space than its corresponding jack, which is located beneath the drop instead of at the bottom of the board as in former practice. A general line of house goods and hotel equipment was shown, including a 100-line "annunciphone" associated with a safeguard fire alarm attachment. A marine telephone set of robust design was exhibited; also the "Ever-Sure" automatic vestibule apartment house telephone system, which is non-interfering. A new distributing box for telephone connections was shown, the principal feature being connections on each side for the main cable and two separate toes.

The Thompson-Bonney Co., of New York, showed for the first time an electrically driven revolving window display case equipped with plate glass trays and miniature lamps. The motor for driving was rated 1-20 hp. There was also shown a small motor for musical instrument or sewing machine work. Railway fittings and insulating material were exhibited, together with a jeweler's and optician's motor driven drill 10 in. high.

Herbert W. Smith, Boston, representing the Teater-Heany Development Company, the Chicago Mica Company, Rhode Island Electric Works, Swazey & Smith, Inc., the Waterbury Co., Prometheus Electric Co. and United Copper Foundry Co., showed fire-proof magnet wire, "mica bond" insulating material in various forms, magnet wire, a corrugated trolley pole, low and high-tension bracket arms, self-lubricating trolley wheel, wire and marine ropes, lead-covered cables, panel and switchboards, rubber covered wire, and "Process" copper, 4-in. and 6-in. trolley wheels. A test piece of "Process" copper was exhibited; it had broken at a tensile stress of 46,540 lbs. per sq. in.

The S. H. Couch Co., of Boston, exhibited a large assortment of telephone apparatus, including an intercommunicating combination automatic telephone and annunciator for apartment house service, flush automatic telephones for residences, a 100-line visual target exchange board, new automatic desk set containing 26 stations, stated to be the highest number of stations thus far built for such service, and a full line of hand and wall instruments for common and individual battery service. The casting on the apartment house sets is in one piece, with cleanable celluloid strips for names and numbers. Special attention was paid in the exhibit to automatic service.

The Ovington Mfg. Co., of Boston, exhibited its "Ovington Electro-Therapeutic and High Frequency Apparatus," which supplies every form of current that a physician requires, which means 10 currents besides a high-frequency discharge. Numerous interesting and spectacular high-voltage experiments were frequently performed in this exhibit.

The American Steel & Wire Company maintained headquarters in the main hall.

A working model of the Automatic Electric Train & Station Annunciator Company's system was shown in an exhibit, the headquarters of the company being at Lexington, Mass. The E. R. Brown Beer Pump Co., of Boston, showed a beer pump driven by a 1-7 hp motor.

The Renim Specialty Co., of Boston, exhibited switch and outlet boxes, cut-out cabinets and quartered oak trims. "Ideal" floor treads were also shown. A new cast-iron cut-out cabinet adapted for a combination cut-out and switch was shown, the device being adapted to either flexible or iron conduit.

The Stuart-Howland Co., of Boston, in a large space, showed Helios-Upton enclosed arc lamps, magnetos and interrupters for automobiles and power boat service, gongs, bells, fans, spark coils, gas lighting supplies, "Pagoda" shades and telephone apparatus, besides other general supplies.

The Dale Co., of New York, occupied an exhibit including electric lighting specialties, sockets, standards, wireless clusters, fittings, portable lamps, shades, fixtures and brackets.

Watchmen's clocks were shown by Simplex Time Recording Co., of Gardner, Mass., and by the E. Howard Clock Co., of Boston. The latter company showed a regulator master clock driving a 4-ft. secondary, an electric watchman's clock with unlimited station capacity, a recording watchman's clock, and the 150 station magneto-watchman's clock recently completed for Jordan, Marsh & Co., of Boston. The latter is the largest clock of the magneto type ever built.

The Alphaduct Mfg. Co., of New York, displayed about 15,000 feet of flexible interior conduit varying in size from ¼ in. to 1½ in. The interior of this conduit is cotton duck finish dusted with powdered soapstone. The Addressograph Co., of Boston, also exhibited its product.

The McKenney & Waterbury Co., of Boston, showed an artistic grouping of art glass and portable lamp fixtures to match in the Elizabethan, Art Nouveau, Renaissance, Rococo and Flemish Dutch styles. A ball-bearing adjustable bracket was also exhibited. It was the object of the exhibit to show what could be done in harmonizing color schemes and lighting effects, and this was notably accomplished.

The National Carbon Co., of Cleveland, Ohio, exhibited arc light carbons for open and enclosed service, an electric furnace carbon 6 in. in diameter and 52 in. high, carbon brushes and dry batteries. This company also brought out a new battery for railway signal and fire alarm service, called the "Columbia closed circuit battery." The elements are zinc, copper, oxide and caustic soda dissolved in water. A 300-ampere hour discharge is guaranteed at about .7 volt. A new line of flash lights for household use was also shown.

C. S. Knowles, of Boston, displayed high-tension porcelain insulators for voltages of 10,000 to 60,000, and glass insulators for potentials up to 40,000 volts. Samples of enamel duct from ½ in. to 4 in. diameter were shown, with porcelain fittings for wiring installations, steel insulator pins and angle iron transmission cross-arm braces. The Worcester Polytechnic Institute's 200,000-300,000 volt transformer was in service in the Knowles exhibit for insulator testing and high-tension experiments. The current supply for this transformer was provided by a motor-generator set furnished by the Frank Ridlon Co., of Boston.

John A. Roebling's Sons Co., of New York, maintained headquarters at the exhibition.

The Marshall Electric Mfg. Co., of Boston, exhibited baby knife switches, Dow lamp adjusters, snap switches, and indicating snap switches in which the lettered plate is held from slipping by a small rivet.

Peter Forg, of Somerville, Mass., exhibited a variety of adjustable electric light fixtures with telescopic arms and ball and socket joints. Special designs for students' use, doctors, architects and draftsmen were shown, together with shop fixtures. A feature of the exhibit was the Forg steel drop forged automobile sprocket wheel.

The Benjamin Electric Mfg. Co., of New York, exhibited wireless clusters approved by the National Board of Fire Underwriters up to 650 volts; the "arc burst" cluster composed of 6 Meridian frosted lamps in a horizontal plane and one in a vertical plane; and the "Daylight" cluster composed of 6 Meridian lamps fitted with diffusing reflectors. These wireless clusters are built up to 50 lights capacity and present an interesting example of advanced illumination. The "arc burst" cluster was rated at 205 cp and equipped with two inverted top shades and a Prismo shade on the bottom; the Daylight cluster gave better effects with only 150 cp and diffusing reflectors.

The Miniwax Co., of New York, supplied the exhibition with fire extinguishers and also had an exhibit of these devices.

The Worcester Electric Mfg. Co., of Worcester, Mass., exhibited a handsome panel board mounted in antique oak, knife and quick break switches, fuse blocks and an isolated plant switchboard complete in one panel.

The H. T. Paiste Co., of Philadelphia, exhibited a full line of sockets, P. K. rosettes, panel boxes, attachment plugs, cut-outs and switches.

Five triplex, duplex and differential chain blocks, hand hoists varying from 1 ton to 20 tons capacity were shown by the Yale & Towne Mfg. Co., of New York. The 20-ton hoist can be handled by one man at a pull of 140 lbs. on the hand chain; the full load rises .6 ft. per minute with 79.5 per cent mechanical efficiency. There was also one 2-ton electric hoist driven by a 3-hp motor. This outfit had a single upper hook, making it portable for use on any suitable overhead support or trolley.

The Albert Champion Co., of Boston, exhibited electric specialties for automobile service, including battery sets, small lamps, spark plugs, rubber-covered wire and gauges. The Manhattan Electrical Supply Co., of New York, maintained headquarters and showed flush plug receptacles and "Sarco" combined outlet and junction boxes.

Samples of wire and rubber were shown by the Eastern Electric Cable Co., of Boston.

The Heinze Electric Co., of Boston, showed a large assortment of X-ray and wireless telegraph apparatus, automobile spark coils, a motor-driven mechanical interrupter for induction coil or theatre dimming service, and a 50-in. induction coil for experimental and spectacular purposes.

The Shelby Electric Co., of Shelby, Ohio, had a lamp testing room fitted up with a Queen photometer and a compartment divided for comparative tests of different commercial lamps.

The O. C. White Co., of Worcester, Mass., displayed a large variety of adjustable fixtures for machine shops, desks, drafting rooms, studios, libraries and banks.

Dossert & Co., of New York, showed joints for connecting wires or cables without the use of solder, ranging from 12-wire to 2,000,000 cm cable, trolley splicers, top joints, top hooks and aluminum connectors. Lugs for panel boards and switches were also displayed.

Automatic electric pianos were shown by the Wood Piano Co., of Boston, and visible typewriters by the Wellington Mfg. Co., of Boston.

Johnson & Morton, of Utica, N. Y., exhibited their "Universal" direct connection panel, style BD distributing cabinet, storage battery charging switchboard and knife switches.

The exhibit of the Valentine Electric Sign Company, of Atlantic City, showed the manner of applying the stock letter to various uses, such as in panel signs for either grooved or black letters or in skeleton frame signs. The stock letters are made of galvanized-iron finished in red and white enamel, and they are practically waterproof. A sign built for small first cost and operating expense was shown in a drug store unit lighted by four 8-cp lamps. Colored lamp signs were also exhibited.

The Trumbull Electric Manufacturing Company, of Plainville, Conn., exhibited panel boxes, switches, cut-outs and porcelain fittings. Two Baker electric automobiles were shown and the Electric Vehicle Company, of Hartford, also exhibited an attractive carriage.

The American Electric Sign Company, of New York, furnished practically all the illuminated signs in the general exhibit work and in its own booth the company showed an interesting variety of signs, flashing mechanisms, time switches and an advertising mirrorgraph.

The International Instrument Company, of Cambridge, Mass., exhibited a laboratory clock, laboratory accessories, an electric centrifuge for rapid precipitation, used in testing for solid matter in milk and other liquids, a 10-hp absorption brake and an electric chronograph.

The H. W. Johns-Manville Co. displayed Sachs Noark and National Code standard fuses up to 10,000 volts, 50 amp., and 600 volts, 600 amp., subway cable and fuse boxes, "Electrobestos" and "Transite" conduits for car wiring, Manville fire extinguishers and trolley line material.

"Eastern" dry batteries, No. 3 and Atlantic types, carbon brushes, plates and cylinders showing the steps in brush manufacture were exhibited by the Eastern Carbon Works, of Jersey City.

The Steel City Electric Company, of Pittsburg, Pa., showed Fullman bushings, locknuts and floor outlets, "Universal" insulator supports and beam straps, conduit benders and Thompson reamer attachments.

The Holtzer-Cabot Electric Company, of Brookline, Mass., showed a large number of small motors for varied service, gongs, telephone supplies, annunciators, motor-generators and experimental equipment.

Charles A. Cotton, of Boston, exhibited a line of Triumph motors from ½ hp to 15 hp, and Century self-starting, single-phase motors from 3 to 5 hp, 60 cycles. Charles L. Garrison, of Boston, exhibited a 1-kw De Laval steam turbine, speed 25,000 r.p.m., and steam pressure 150 pounds.

The Blake Electric Company, of Boston, showed a line of cut-out tablets, starting boxes, fan motors and general supplies; the Holophane Glass Company, of Chicago, displayed a great variety of shades and globes, and the Economical Lamp Company, of New York, exhibited a turn-down incandescent lamp. Booth & Co., engineers and contractors, Boston, maintained headquarters in the building and John L. Gleason, of Boston, exhibited universal moulding boxes, junction and reduction boxes for 2 and 3-wire circuits, from ¼ in. to 1 in. groove.

The A. C. & M. L. Felkin Co., of Boston, exhibited "Imperial" electric signs adapted for day and night service, internally lighted, with inside reflectors of galvanized iron. The Little & Emerson Co., of Boston, showed an electric calendar; the Olds (Boston) Gasoline Engine Works a gasoline engine exhibit; the Cooley General Development Company, of Boston, a rotary engine installation, and Dunton & Field, of Cambridge, Mass., tree insulators.

The following were the concerns interested and their representatives:

ELECTRICAL WORLD AND ENGINEER. J. M. Wakeman, George W. Elliott, T. C. Martin, H. S. Knowlton.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY. B. L. Warren, J. C. McQuiston, D. E. Manson, C. B. Humphrey, G. B. Griffin, G. C. Ewing, C. Wahn, G. L. Osborn, G. M. Bates, L. Watts, P. Bond, G. Gibbs, L. W. Reed, M. H. Merrill, H. M. Young.

NERNST LAMP COMPANY. E. W. Clark, Mr. Holbrook.

GENERAL ELECTRIC COMPANY. F. H. Gale, J. P. Felton, R. B. Hanson, O. F. Brastow, W. M. Wright, C. B. Davis, Mr. Kinney.

DOSSERT & Co. J. L. Holland, H. A. Bristol, M. R. Jarvis.

RENIM SPECIALTY COMPANY. M. Robinson.

SPRAGUE ELECTRIC COMPANY. Alex. Henderson, H. C. Farnsworth, H. H. Hornsby.

I. P. FRINK. Frank Stout.

OSBURN FLEXIBLE CONDUIT COMPANY. C. E. Corrigan.

AMERICAN ELECTRIC LAMP COMPANY. C. J. Purdy, general manager.

MUNDER ELECTRIC COMPANY. C. F. Munder.

IMPROVED MOULDING MANUFACTURING COMPANY. W. T. McDowell.

MARSHALL ELECTRIC MANUFACTURING COMPANY. Norman Marshall.

HOLTZER-CABOT COMPANY. A. W. Waterman, E. F. McCobb, T. W. Ness.

HOLOPHANE GLASS COMPANY. I. W. Farquharson, H. C. Jones.

H. T. PAISTE COMPANY. E. A. Jenkns, C. I. Hills, George MacElwee.

R. M. CORNWELL MANUFACTURING COMPANY. Hiram Cornwell, F. S. Baldwin.

CONDIT ELECTRIC MANUFACTURING COMPANY. S. B. Condit, Jr., F. W. Nason, J. Fisher.

JOHNSON & MORTON. W. H. Morton, M. H. Johnson, J. H. Cramphorn.

AMERICAN ELECTRIC SIGN COMPANY. C. I. Wetmore, J. L. Russell, C. M. Borden.

H. W. JOHNS-MANVILLE COMPANY. A. D. Newton, J. W. Perry, Joseph Humphreys, W. R. Walsh, E. L. Cameron. E. B. Hatch, Joseph Sachs, Johns-Pratt Company.

CHASE-SHAWMUT COMPANY. H. P. Moore, J. J. Miley, F. D. Masterson, J. T. G. Nichols, Jr.

WORCESTER ELECTRIC MANUFACTURING COMPANY. James McGrady.

ELECTRIC-GAS LIGHTING COMPANY OF BOSTON. H. C. Thomson, C. E. Lee, A. F. Boardman, C. R. Sherman, C. F. Howes, C. H. Young.

O. C. WHITE COMPANY. O. C. White, Jr., F. M. Pond.

EASTERN ELECTRIC CABLE COMPANY. H. M. Daggett, C. W. Knight.

TRUMBULL ELECTRIC MANUFACTURING COMPANY. J. H. Henry, Frank Trumbull, G. W. Edge, T. D. Watson.

SIMPLEX ELECTRICAL COMPANY. Mr. Davis.

YALE & TOWNE MANUFACTURING COMPANY. C. W. Beaver, William Hazleton, John T. Boyd.

EASTERN CARBON WORKS. George W. Mills, Williams Mills, O. L. Turgeon.

NATIONAL CARBON COMPANY. A. C. Henry, J. C. Irvine.

MANHATTAN ELECTRIC SUPPLY COMPANY. J. W. McDowell.

HARVEY HUBBELL. H. W. Bliven, Joseph Rogers.

PETTINGELL-ANDREWS COMPANY. C. B. Price, F. W. Cramphorn, W. J. Keenan, Messrs. Peterson, Palmer and Jones.

S. H. COUCH COMPANY. S. H. Couch, W. Couch, C. E. Monroe.

STUART-HOWLAND COMPANY. G. M. Stuart, A. Howland, J. W. McNair, C. B. Wetmore, A. E. Payne, R. M. Merritt, Harry De Steese, J. B. Bailey, C. R. Fish, J. E. Wilson, J. T. Hessel, H. C. Dalton.

SIMPLEX ELECTRIC HEATING COMPANY. J. I. Ayer, C. W. Richards.

AMER. CIRCULAR LOOM COMPANY. A. T. Clark, H. B. Kirkland, T. H. Bibber, M. W. King, R. B. Corey, H. C. Adams, Jr.

D. & W. FUSE COMPANY. C. E. Harmon, W. S. Sissons, L. W. Downs.

AMERICAN ELECTRIC & NOVELTY MANUFACTURING COMPANY. F. J. Alvin, S. S. Shepard.

SARCO COMPANY. Ralph A. Schoenberg.

G. M. GEST. W. T. Jackson.

DALE COMPANY. J. H. Dale, O. J. Bryan, H. S. Ransford.

ELECTRO-DYNAMIC COMPANY. G. H. Condict, Messrs. Bell, Mitchell and Warner.

COUCH & SEELEY COMPANY. E. B. Seeley, F. C. Redfield.

ALPHADUCT MANUFACTURING COMPANY. Russell Dart.

GILMORE ELECTIC COMPANY. William Gilmore, E. L. Brown, E. E. Fernald.

DIEHL MANUFACTURING COMPANY. B. C. Kenyon, H. S. Miller.

JOHN A. ROEBLING'S SONS CO. H. L. Shippy, F. W. Harrington, Messrs. Mann and Van Ortwick.

BOSSERT ELECTRIC CONSTRUCTION COMPANY. F. T. Foxenberger, F. B. Smith, W. P. Crockett, R. B. Corey, C. W. Bongard.

HART MANUFACTURING COMPANY. H. A. Hart, F. B. Smith, W. P. Crockett, C. W. Bongard.

PASS & SEYMOUR. John W. Brooks, W. B. Hall, A. M. Little.

DE VEAU & Co. A. S. De Veau.

BRYANT ELECTRIC COMPANY. V. C. Gilpin, E. R. Grier, Ed. Patton, W. C. Bryant.

AUTOMATIC ELECTRIC TRAIN & STATION ANNUNCIATOR COMPANY. Henry T. Goold.

Equipment for New Plant of the New York Edison System.

Work is being pushed actively on the new plant of the New York Edison Company, adjoining immediately the well-known Waterside station, on the East River at Thirty-ninth Street. The older plant is running to its full capacity, and the current from the new will be needed this fall. The order for the initial equipment has fallen to the Westinghouse interests, which met the requirements and guarantees as to delivery, etc., it being imperative that current should be available in view of the rising demand due to the reduction in price of current and the enormous peak of the load at the Christmas holiday season. Waterside station No. 1, it will be remembered, is equipped with Westinghouse vertical, three-cylinder, compound reciprocating engines which, although installed only a few years ago as then representing the highest type of large engine construction, have apparently been outclassed through the rapid advance of the steam turbine system. No less than eleven of these large engine type units are now in service in this station, each rated at about 6,500 horse-power capacity and direct connected to a 3,500-kw generator. The next step in the acquisition of larger units resulted in the installation of 5,000-kw turbine units of the Curtis type. In the equipment of the new Waterside station with two Westinghouse turbine units of 7,500 kilowatt capacity, over twice that of the original engine type units, there will here exist a striking example of the extremely rapid development in power station construction that has taken place since 1900.

The extreme compactness of the new generating unit is evidenced

by the small space it requires in the new power station arrangement. Its over-all dimensions are approximately: Length, 50 feet; width, 17 feet; height, 15 feet; floor space, 850 sq. ft. per unit net, or .113 sq. ft. per kilowatt capacity. This is less than one-half the space occupied by the engine type units which are the most compact type yet built for central station work. A condenser of the surface type will be located beneath the turbine in the foundations proper. This arrangement is in all respects equivalent to that claimed to be incidental only to the vertical type of turbine which requires much extra space for condenser and turbine auxiliaries.

The new turbines will operate under 175 lb. steam pressure, approximately 28-in. vacuum and 100 degrees superheat, the normal speed of the unit being 750 r.p.m. Under these conditions the consumption of the complete unit will be in the neighborhood of 16 lb. per kw-hour at full rated load. Each unit will have an overload capacity of at least 50 per cent, or will be capable of developing full rated load without the use of a condenser. A distinctive feature of this design is that the turbine gives its best economy around full rated load, although a large overload capacity is at all times instantly available when required without material sacrifice of efficiency. At this maximum load each turbine will be developing over 15,000 horse-power at the shaft, which is by far the greatest amount of power ever developed in a single prime mover in stationary service.

The direct connected turbo-generators will be of standard Westinghouse construction, delivering 6,600-volt, three-phase current to the high tension network at a frequency of 25 cycles per second. The generators will embody the new enclosed construction which constitutes an important advantage in the entire elimination of the hum peculiar to high-speed turbine generators. They will have an efficiency approximating 97½ per cent at full rated load. Each generator will be able to sustain for several hours an overload of 50 per cent within reasonable temperature rise.

It is of interest in connection with this important installation that, almost simultaneously, three Westinghouse turbine units of the same size have been ordered for two large Brooklyn power stations, one for railway and the other for lighting service, making a total of over 50,000 horse-power in turbine machinery of this size. Two units will go to the Brooklyn Heights Railway Company, and the third to the Brooklyn Edison Company. Such orders reflect the prosperous condition particularly of the electric lighting business, and the expansion of the industry for producing current.

Radial Arm Crane Controllers.

The illustrations herewith show a new type of crane controller, known as the radial arm, which is being placed upon the market by the Cutler-Hammer Manufacturing Company, of Milwaukee. In designing these controllers the purpose was to overcome the difficulties met with in former types and to attain, with the most simple construction possible, proper control with the minimum number of points at which arcing could occur as the controller deteriorated in service, and to make certain that when arcing did occur it would be under predetermined conditions and with ample protection. In addition, provision was made for ease of operation, adaptability to all conditions of service, ease of renewals and interchangeability of parts.

In types B and C these ends were achieved by mounting the front above the resistance, thus giving free accessibility to the connections on the back of the slate. The front itself consists of four sets of segments, the connections of which are so arranged that no reversing sector is necessary. The resistance is also arranged in four sections, each connected to its respective set of segments, making the wiring simple and eliminating all crowding. The lever is in three pieces, insulated from one another by large pieces of insulating material, sufficiently massive to withstand any mechanical strain to which they may be subjected in use.

The blow-out consists of a coil surrounding and embracing the controller shaft on the front of the controller, and the iron of the framework is so disposed as to complete the magnetic circuit and give a powerful blow-out action at each of the four points at which the circuit is broken. The provision of a multiple protected break for the circuit reduces destructive arcing to a minimum. A reliable center indicating device is provided at the "off" position, which enables the operator to feel the central or "off" position, but which will in no way prevent his reversing quickly.

The type A controller differs from the above only in the mounting of the resistance, which is of iron-enclosed tube porcelain-insulated construction, and is carried directly by the front. The resistance may, therefore, be removed from the enclosing case and mounted

FIG. 1.—CRANE CONTROLLER.

directly in a recess provided, should this be desirable, as is frequently the case in applying it to small trolley hoist work, etc. Or it may be rotated within the case so as to permit it being placed in any desired position, as on the sides or top of crane cab. It may also be arranged for rope operation from the floor, in which case a centering spring is provided.

Types B, C and D may be provided with bell crank and link to

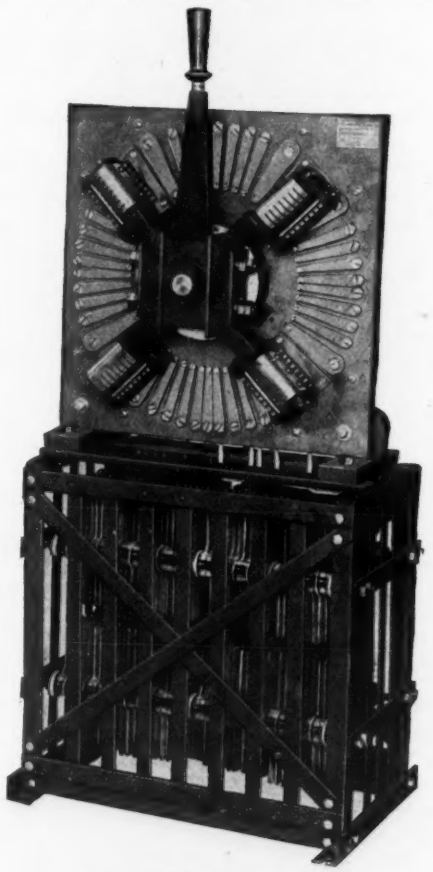


FIG. 2.—CRANE CONTROLLER.

permit of installation at the back of the cab by levers at the front. Resistance is provided which will give a speed reduction of 50 per cent under the average load conditions on the crane.

The controllers are designed to occupy the minimum space consistent with the duty they are required to perform, and their arrangement is such that the operator's view is practically unobstructed. Arrangements for slow speed control may be obtained in types B and C.

Railway Type Circuit-Breaker for Direct-Current Uses.

The street railway circuit-breaker shown in the illustration combines in one piece of apparatus a safety device and main switch, as it automatically opens the circuit on overload or short circuit, and can be operated by hand to disconnect the car from the trolley circuit. It is intended to be installed over the motorman's head, in the place usually occupied by the canopy switch, but may be placed elsewhere if desired. It can be quickly closed, thus avoiding the inconvenience and delay incident to replacing a fuse.

This circuit-breaker is intended for direct-current use, and is made for capacities of 60, 100, 150 and 200 amp., with a range from 90 to 225 per cent of normal rating. The mechanism is mounted on a cast-iron base and enclosed by a pressed-metal cover. The handle for resetting projects conveniently from the side of the case and the plunger for tripping by hand extends through the cover and is provided with a composition handle for the hand to strike against. The resetting handle is connected to the switch lever through a compression spring, which insures a firm pressure and good contact, regardless of the natural wear to which the parts may be subjected in service.

The arc is broken in a powerful magnetic field, which effectually

RAILWAY CIRCUIT BREAKER.

opens the circuit under the most severe conditions. The contacts on which the arc occurs are surrounded by a shield of insulating and arc-resisting material, which prevents the arc from being communicated to any other part of the breaker. The contact is made up of copper strips separated by spaces, each acting independently of the others, and in this way a slight irregularity or burr will affect the individual strip only without disturbing the other strips, as would be the case in a brush made in the usual way with laminations without spaces. An auxiliary contact at the end of the switch lever, which can easily be removed and replaced by a new one, serves as an arcing pit. A feature of this breaker is the accessibility when the cover is removed.

The current adjustment is made by means of a knurled head screw, which engages a nut attached to a coiled spring, which in turn opposes the pull of the magnet on the armature. A trigger holds the switch in the closed position, and is in range with a projection on the armature of the tripping magnet. When the armature is drawn down by an excessive current in the coil this projection strikes the trigger and releases the switch lever, which is opened instantly by a coiled spring.

The new breaker, improving upon the former type made by the Westinghouse Electric & Mfg. Co., has a cast-iron base, with a sheet-metal cover, a lighter construction than in the former type of cast-iron circuit-breaker, and one giving greater accessibility to the parts for repair, upon the removal of the cover. The contact is made of copper strips, giving a better connection in the event of a burr or any irregularity. The entire construction is lighter and more compact than that of former practice.

Water-Tight Floor Outlet.

The outlet box which is shown in the accompanying illustration was designed with a determination to meet all the conditions encountered in actual practice. It will be appreciated by practical men that there is almost inevitably a disturbance in the accurate and

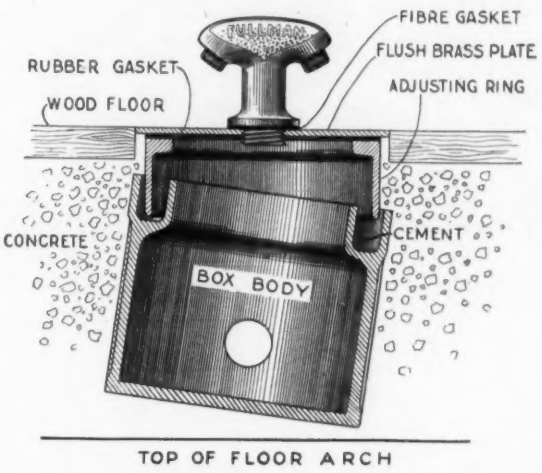


FIG. 1.—SECTIONAL VIEW, SHOWING HOW THE CROOKED SETTING OF BOX BODY IS TAKEN CARE OF.

level setting of the box body after being installed. The conduits being rigidly secured to the box every disturbance of the conduit disturbs the box, and it is the exception to find boxes that are not considerably out of level when the finishing work is to be done. The Fullman universal adjustment outlet affords a simple and practical remedy.

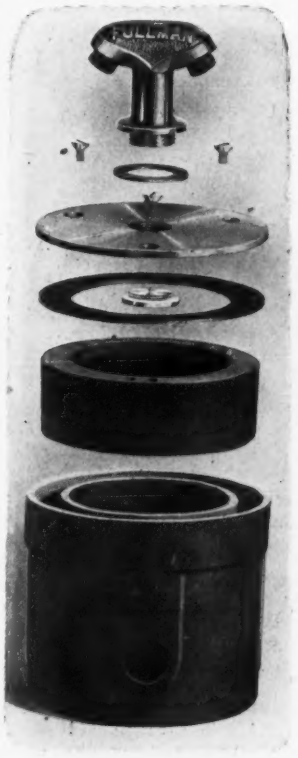


FIG. 2.—VIEW, SHOWING PARTS READY FOR ASSEMBLING.

By reference to the illustrations the method of adjustment will be made clear. The box body is placed in position when the conduits are run, and nothing else is done toward finishing until the flooring is laid. The completion is as follows: The wooden flooring is neatly trimmed to the size of the plate and the ring is suspended in the groove in the upper edge of the box body by means of a template resting on the floor, and while suspended in this position the groove is filled with melted cement, which is of special composition and sets immediately; the template is removed, the rubber gasket applied and the cover plate fastened down by the screws.

FIG. 3.—BRASS FLANGE RINGS.

These floor outlets are manufactured by the Steel City Electric Company, Third Street and Penn Avenue, Pittsburg.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—General trade and industry are, to a large extent, still governed by midsummer influences, but better weather and better crop reports have had a stimulating effect on trade in the surplus cereal-producing sections of the West. Very favorable reports as to fall trade orders come from nearly all points west of the Alleghanies, north of the Ohio River and thence westward to the Pacific. Large—though, except in a few cases, not record-breaking—crop yields now appear reasonably assured in that region, and there is a general agreement that fall business already booked exceeds that for a year ago at this date. Less assurance is found in the reports from the western half of the South, where considerable damage is reported done by heavy rains to cotton, wheat and other crops, this partially offsetting the favorable influences of the recent heavy advance in cotton prices. There is evidence of cross currents in iron and steel, the latter being active and strong, while crude iron, though displaying more activity, is still weak or lower in most markets. Pig-iron production decreased slightly in June, but for the first half of 1905 the output was slightly in excess of 11,000,000 tons, a gain of 34 per cent over the first half of 1904 and of 13 per cent over the record six months' production in the first half of 1903. It exceeded that of the last half of 1904 by 32 per cent. Stocks of unsold iron increased slightly during June. For the week pig iron has been more active, but prices have been shaded 25 to 50 cents per ton to get business. Northern foundry iron has been cut 25 cents, with good sales reported at eastern points and large inquiries pending. Furnaces are piling iron in the Pittsburg district, and coke is lower, though shutdowns of ovens are expected to right this later. Structural material is active and good sales of rails have been made. The rail mills are sold ahead to 1906. Reports as to the first half of the year's operations point to an enormous turnover, far exceeding corresponding periods of previous years. Iron production was unprecedented in that period, railway earnings show 6.5 per cent gain over a year ago, and are, therefore, the best ever recorded in a first half year, and foreign trade, mainly owing to enormous cotton shipments, increased exports of manufactured goods, and record imports of materials for manufacture will surpass the best of previous years. Copper during the week was active, and there was a good demand both for home trade and for export. Producers are busy. Lake is quoted at 14⅞c. to 15c., electrolytic at 14¾c. to 14⅞c., and casting stock at 14⅜c. to 14½c. *Bradstreet's* reports 166 business failures during the week ended July 13, as compared with 127 the week previous and 203 in the corresponding week last year.

ELECTRICAL EXPORTS.—Attention was called a couple of weeks ago to the excellent figures of electrical exports. It was noted that the exports of electrical machinery for the ten months ending April were $5,854,974, a gain of one million over 1903, and of at least $1,250,000 over 1904. The figures for April itself were $564,883, or nearly $35,000 better than in 1904. The exports of electrical instruments, additional to the above, also continue large. While a little less than in 1904, the total is nearly $500,000 better for the ten months than in 1903, being $3,060,126, while for April it was $443,478, as compared with $311,440 in April a year ago. The detailed figures for May are now out and make a good showing again. The export of electrical machinery in May, 1904, was $517,961; for May this year it was $806,702. For the eleven months including May it was $5,047,268, in 1904, where for the eleven months of this year it is no less than $6,661,676, a splendid gain well distributed in the demand from all parts of the world. The export of electrical instruments for the month is also excellent. In May, 1904, it was $292,997; this May it was $430,092. For the eleven months the showing is equally good, being $4,490,818, as compared with $4,486,647 last year, both years being much in excess of 1903. At the present rate, therefore, the total export of electrical machinery and instruments for the year will reach well over $12,000,000.

ELECTRIFYING WEST SHORE.—The *Wall Street Journal* says that work for the electrification of the West Shore Railroad is under way and the Vanderbilt management has practically let contracts for all the construction necessary for the electrification of that portion of the West Shore road between Syracuse and Utica. It is understood that all the contracts are to go to the Oneida, New York, Railway Company. This company has already built west as far as Canastota. Because of a change in its plans the Vanderbilt management will not have the electric cars on the West Shore go entirely through Syracuse. They will run to Eastwood, near Syracuse, where connections will be made with the Eastwood branch of the Syracuse Rapid Transit Company. The reason for the change is the present intention of the management to elevate all the tracks through Syracuse and abolish grade crossings. It is stated that Syracuse is to be the dividing point between the zones using Niagara and Hudson River power.

PANAMA TROLLEY CONTRACT.—The terms of the proposed trolley contract for Panama City have just been made public in the bulletin of the United States Department of Commerce and Labor. Bids are to be opened July 24. The successful bidder undertakes to construct, operate and keep in active service a street tramway for the streets of Panama propelled by electricity. The line will have as a starting point the Plaza de Armas, following a course along Carreras Nacional, Ricaurte, Bolivar, Constitucion and Istmo up to the new station of the Panama Railroad Company, the public market, and the cemeteries. The contractor will be at liberty to construct other branch lines at such a time as the requirements of the traffic shall require it, to pass through the most convenient streets for the construction, operation and rapid service of the tramway. The contractor likewise undertakes to arrange with whom it may concern to secure the privilege of extending the principal line to the "sabanas" of the city and up to La Boca, the branch line passing by the cemeteries. A five-cent fare is specified.

MISSOURI RIVER POWER.—Some articles have already appeared in these pages as to power development in Montana from the Missouri River. The Helena (Mont.) Power Transmission Company, a subsidiary company of the Missouri River Power Company, is now to undertake the construction of a new dam and power plant on the Missouri River, about 15 miles below its present plant. The plant will have a head of about 60 feet and a capacity of about 20,000 horse-power, which will be transmitted to Helena, Butte and Anaconda. The Missouri River Power Company's transmission lines will be extended from Butte to Anaconda, making a total distance of transmission from the new plant to Anaconda of about 100 miles. This transmission will be operated at 70,000 volts. Mr. M. H. Gerry, Jr., is, as is well known, general manager of the Helena company.

THE CHILIAN CONTRACTING COMPANY has been formed in this city with Mr. J. G. White at its head as president, and Messrs. F. H. Reed and H. U. Wallace, of the J. G. White Co., as directors, associated with such men as E. C. Converse, president of the Liberty National Bank; C. C. Cuyler, of Cuyler, Morgan & Company; G. L. Duval, of Beecher Duval & Company; E. Hewitt, of Cooper Hewitt & Company; F. Strauss, of J. & W. Seligman & Co.; C. Lewis, of W. Salomon & Co.; T. H. Newberry, of Detroit; F. S. Smithers, of that named firm, and C. M. Swift, of Detroit. Information as to the plans of the company are not yet given out, but one project is said to be a harbor for the port of Valparaiso. Mr. White's energy, persistence and ability promise success for this as for his other domestic and international enterprises.

RECENT STURTEVANT ORDERS.—Among recent orders for marine generating sets taken by the B. F. Sturtevant Co., of Boston, Mass., are included those for F. B. Pulson's and Timothy Eaton's private yachts, building at Toronto, Ont., for the tug *Menasket*, and through the Portsmouth Navy Yard, for shops of the United States Navy. Contracts for complete heating and ventilating systems have recently been taken by the B. F. Sturtevant Co. for the Fall River Iron Works Co., Fall River, Mass.; Nashua Manufacturing Co., Nashua, N. H.; Bemis Bros. Bag Co., Kansas City, Mo.; Fore River Shipbuilding Co., Fore River, Mass.; Lewis A. Crossett, North Abington, Mass., and Trenton Brass & Machine Co., Trenton, N. J.

NEW HYDRO-ELECTRIC EQUIPMENT FOR IDAHO.—The Abner Doble Company, engineer, of San Francisco, has recently secured the contract for the machinery to be installed in an addition to the hydro-electric plant of the Cramer Electric Company, successor to the Idaho Electric Supply Company, at Hailey, Idaho. This contract covers the entire water power and electrical apparatus and includes a 400-kw alternator directly driven by an 800-hp set of water wheels, exciter and governor; three-panel marble switchboard, two 25-light arc transformers and 50 arc lamps with regulators, switchboards and other accessories; 14 transformers and other supplies for the distribution system.

TROLLEY RAILS.—The Philadelphia Rapid Transit Company has placed a second order for 8,000 tons of steel with the American Bridge Company.

THE AUTOMATIC ELECTRIC COMPANY has recently closed three contracts of considerable interest to telephone men. The largest is for a 15,000-line automatic telephone system for Havana, Cuba. This is to displace the old "Red Telefonica System" of Havana, formerly owned by a Spanish company, but now a part of the properties of the Cuban Telephone & Telegraph Company. The latter company at the same time contracted for a 600-line automatic system for the town of Marianao, Cuba, a suburb of Havana. The initial installation at Havana will be 5,000 lines. The Cuban Telephone & Telegraph Company will soon erect a new building and lay a new conduit and cable system for the new plant. The officials of the Cuban Telephone & Telegraph Company who went to Chicago late in June to close the contract were President Roland R. Conklin, Vice-President S. L. Jarvis and General Manager W. M. Talbott. The other two contracts recently granted the Automatic Electric Company were for a 250-line exchange at Miamisburg, Ohio, for the Montgomery County Telephone Company, and a 1,200-line exchange for the Dakota Central Telephone Company at Aberdeen, S. D. These two latter exchanges will be the first to have the new automatic four-party-lines with selective ringing and lock-out recently worked out by the Automatic Electric Company's engineers. This new development of the automatic system attracted much attention at the recent Independent Telephone Convention in Chicago, where it was exhibited for the first time. Only a portion of the Miamisburg and Aberdeen plants will be for party line service.

IDEAL ENGINES.—Recent sales of Ideal engines are reported as follows: One 90-hp. Kingan Provision Company, Baltimore, Md.; one 160-hp. Connersville Blower Company, Connersville, Ind.; one 110-hp. Northern Commercial Company, Fairbanks, Alaska; one 160-hp. Northern Commercial Company, Fairbanks, Alaska; one 70-hp. Edward Mauner, New York City; one 55-hp. City Hospital, Minneapolis, Minn.; one 110-hp, Nixon & Kimmel, Harrington, Wash.; one 119-hp, Charles F. Loudon, Terre Haute, Ind.; one 85-hp, Southern Indiana Railway Company, Terre Haute, Ind.; one 182-hp, The Ohio Coal Company, Cambridge, O.; two 150-hp each, Board of Public Works, St. Louis, Mo.; one 125-hp, Vertin Bros., Calumet, Mich.; one 75-hp, Wilkesbarre Gas & Electric Company, Wilkesbarre, Pa.; one 70-hp, James P. Wood Heating Company, Philadelphia, Pa.; one 85-hp, Atchison, Topeka & Santa Fe Railroad Company, Shawnee, O. T.; one 150-hp, Ralph J. F. Gerstle Company, New York City; two 310-hp each, Ralph J. F. Gerstle Company, New York City; one 80-hp, O. M. Carter, Houston, Tex.; one 65-hp, Standard Brewing Company, Cleveland, Ohio; one 125-hp, city of Warren, Minn.; one 250-hp, Stratford Hotel, Chicago; one 75-hp, Guinle & Co., Rio de Janeiro, Brazil; one 125-hp, South Dakota Hospital for the Insane, Yankton, S. D.; one 50-hp, Anglo-Chilean Nitrate & Railway Company, Tocopilla, Chile; one 75-hp, Perkins Hotel, Portland, Ore.; one 110-hp, Great Western Sugar Company, Denver, Colo.

GREATEST FOREIGN TRADE.—American foreign trade maintains its high level, the domestic exports for June being $118,727,467 and the imports $90,435,674. The country's foreign trade in the fiscal year ended June 30, 1905, is in many respects remarkable. In both export and import of merchandise all records are broken. In exports the fiscal year 1901 stands next to 1905, but fell $30,000,000 short of it; in imports the next highest fiscal year was 1903, which did not, however, come within $81,000,000 of the past twelve months' record. Exports were more than double those of 1889; imports were more than double those of 1885. In the past few years, however, imports have been increasing more rapidly than exports. The excess of exports over imports in the past fiscal year is $68,784,000 below the similar excess in 1904, $77,443,000 below 1902 and $263,637,000 below 1901, when the largest excess of exports in our history was recorded. It is also less than the excess of 1900, 1899 or 1898, but with these exceptions surpasses the showing of all other fiscal years in our history. Exports and imports combined, during the fiscal year 1905, were $2,635,970,333, against $2,451,914,642 in 1904 (the next highest), $2,310,937,156 in 1901 and $1,539,508,130 as lately as 1895. The fact that manufactures should have offset the decline in agricultural exports is significant.

WESTINGHOUSE TURBINE OUTPUT.—That the steam turbine is rapidly increasing its foothold in the power field is evidenced by the remarkable increase in the manufacture of the well-known Westinghouse-Parsons type. During the six months ending June 30, 1905, the Westinghouse Machine Company, exclusive builder of the Westinghouse-Parsons type, has contracted for no less than 82,000 kilowatts in turbo-generating machinery, averaging nearly 1,175 kilowatts capacity per turbine unit. These machines range in size from 200 kilowatts to 7,500 kilowatts. The latter will be the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries, the electric railway has claimed the largest number of machines, averaging 1,496 kilowatts in capacity; next in order, industrial plants, averaging 571 kilowatts capacity, and light and power plants, averaging 529 kilowatts capacity. In the order of total capacity, railway plants have required 38,900 kilowatts; lighting plants, 26,300; industrial, 12,000; miscellaneous, 4,800. The equipments represent solely actual sales only, and do not include contemplated business or partially closed contracts.

POWER PLANT FOR NEVADA.—According to the *Wall Street Journal*, Mr. W. Wayne Belvin, president of the British-American Finance Company, who returned to New York last week from a business trip to the new gold fields of Nevada, announced the organization of the Bishop-Nevada Electric Power & Lighting Company, with a capital of $1,000,000. Associated with him in the enterprise is James Butler, the original discoverer of the Mizpah mine at Tonopah; Clay Peters, a capitalist of California; Warner Miller, of New York, and a number of San Francisco capitalists. It is the purpose of the company to build an immense electric plant on the Owens River, near the town of Bishop in Nye County, across the line from Nevada in California and generate the electricity by means of water power to Tonopah, Goldfield and Bullfrog; and also to build and operate electric railways in the State of Nevada. The bonds of the company have been underwritten and the work of construction will begin at once.

TUNNELING THE DETROIT RIVER.—With regard to the announcement made in our pages of the intention of the Michigan Central Railroad to tunnel the Detroit River for electric traction, it is said that the construction and electrification commission, of which Vice-President Wilgus, of the New York Central, is the head, has been given two years in which to complete the tunnel. President Newman, of the New York Central, believes that this is ample time. The exigencies of the situation at Detroit, where in the winter-time the Michigan Central and Canada Southern are at a decided disadvantage, call for haste. The cost of construction, estimated at $10,000,000, will be provided for through the formation of companies subsidiary to the Michigan Central and Canada Southern. The latter will be the holding company for the subsidiary on the Canadian side, while the Michigan Central will look after the subsidiary construction company this side of the river.

CARS FOR HAVANA, CUBA.—The Havana Central Railway Company has placed large orders for electrical equipment and for steel rails in the United States. The electrical equipment will cost about $1,500,000, and the order for steel rails which has been given to the United States Steel Corporation is for 15,000 tons. The Havana Central Railway Company was organized to construct electric railways running from Havana to various points outside of the city which heretofore have been without transportation facilities. The Havana Central is controlled by the interests identified with the Havana Electric Company. Among the directors of the Havana Central Railway Company are W. L. Bull, George P. Hopkins and E. P. Bryan.

G. M. GEST, the expert subway contractor of New York and Cincinnati, has been awarded a contract for the construction of a complete underground conduit system at Washington, D. C., for the Western Union Telegraph Company. This conduit system will be constructed of a specially made steel pipe instead of clay and will connect all of the Western Union Telegraph Company's offices, as well as the department buildings in and around Washington. Work will begin by August 1 and several hundred men will be employed.

MONROE, GA., ELECTRIC PLANT.—Bids will be received until July 31 by the Mayor and council, of Monroe, Ga., for machinery and material and installing complete an electric light plant, embracing two 66x18 high-pressure boilers, a 175-hp Corliss engine, a 120-kw alternating-current generator, 15 arc and 40 50-cp street lights, 900 light transformers and pole line. J. B. McCrary, Senoia, Ga., is the engineer. Address W. H. Nunnally, chairman of council.

THE STROMBERG-CARLSON TELEPHONE COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Auburn, N. Y.; Bird City, Kan.; McDonald, Kan.; Coldwater, Mich.; Hannah City, Ill.; Pitman, N. J.; Lewisport, Ky.; Huntersburg, Ind.; Ormsby, Minn.; Seattle, Wash.; Arcadia, Mich.; Mulkeytown, Ill.; Tonica, Ill.; Lostant, Ill.; Sinclair, Tex.; Center, Kan, and Mexico, Mex.

APPARATUS WANTED.—It is stated that Mr. B. S. Kincart, Lebanon, Ky., engineer in charge of the Campbellsville Electric Light plant, will give contracts about July 25 for the following equipment: One 60-kw, 220-volt, direct-current generator; one 90-hp engine, automatic side crank, speed about 175 rev.; one fire tube boiler, 66 inches diameter and 16 feet long; one inclosed feed water heater; one duplex feed water pump.

PLANS FOR CRESTON, IOWA.—Plans are proposed and in preparation for a $50,000 electric light plant, it is said, and bids are to be asked for shortly.

PLANT FOR GREENWOOD, WIS.—Bids will be received by Elias Peterson, city clerk of Greenwood, Wis., on July 25, for the construction of an electric light plant consisting of dynamos, wiring, pole line and auxiliaries; also frame power house, concrete power dam, turbine water wheel, etc. Oscar Claussen, St. Paul, Minn., is the engineer.

Financial Intelligence.

THE WEEK IN WALL STREET.—At the close of the week the stock market showed strength after an earlier reaction due to speculative profit-taking. Crop prospects are interpreted favorably by Wall Street, and that quarter is also inclined to the belief that money will continue comparatively easy for some time, owing in part to the probability of large amounts of foreign capital being sent here during the crop-moving season. Manipulation of leading issues like Northern Pacific and support by large interests continue, however, to be in evidence. The Steel stocks have been strong on intimations of favorable earnings and reports of increased demands for structural material. The traction group showed strength under the lead of Brooklyn Rapid Transit, the increasing earnings of these properties being a matter of more or less note. This stock reacted, however, and, after touching 72⅛, closed at 69¼, a net loss of 2⅜. Allis-Chalmers, common and preferred, closed at 14¾ and 55, respectively, these figures representing net losses of 1⅛ and 3⅛ points. General Electric is down 1¼ points and closed at 177½, while the net loss on Westinghouse preferred was no less than 6½ points, the closing figure being 194. Common closed at 167½, a net loss of ½ point. Electric Storage Battery lost ½ point, closing at 82½. Metropolitan Street Railway closed at 126, which is a net decline of 2⅞ points, and Interborough Rapid Transit closed at 202. Western Union was very quiet, with a downward tendency, the closing price being 93⅛, a ⅜-point loss. Trading on the curb was a little more active, but prices were irregular. Following are the closing quotations of July 18:

NEW YORK

	July 11	July 18		July 11	July 18
Allis-Chalmers Co.	14	16¾	Electric Vehicle pfd.	27	25⅛
Allis-Chalmers Co. pfd.	52	50	General Electric	176	174⅛
American Tel. & Cable	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	137	139	Interborough Rap. Tran.	200¾	203¾
American Dist. Tel.	29	29	Metropolitan St. Ry.	125¾	127¼
Brooklyn Rapid Transit	69⅛	69⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	20	20	Western Union Tel.	93	93
Electric Boat pfd.	60	60	Westinghouse com.	162	167
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..
Electric Vehicle	20	18			

BOSTON

	July 11	July 18		July 11	July 18
American Tel. & Tel.	139	139	Western Tel. & Tel. pfd.	99¼	101
Cumberland Telephone	117	117⅝	Mexican Telephone	1¼	1¼
Edison Elec. Illum.	*245	243	New England Telephone	138¼	139
General Electric	..	..	Mass. Elec. Ry.	*19	18
Western Tel. & Tel.	18	18	Mass. Elec. Ry. pfd.	63	63

PHILADELPHIA

	July 11	July 18		July 11	July 18
American Railways	50	51	Phila. Traction	89¾	90⅞
Elec. Storage Battery	78	81	Phila. Electric	8¾	8⅝
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	28	27½
Elec. Co. of America	11¾	11¾			

CHICAGO

	July 11	July 18		July 11	July 18
Central Union Tel.	..	..	National Carbon pfd.	118	117½
Chicago Edison	159	..	Metropolitan Elev. com.	23¾	23¾
Chicago City Ry.	*190	..	Union Traction	..	..
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
National Carbon	63	63½			

* Asked.

DIVIDENDS.—The Milwaukee Electric Railway & Light Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable July 31. The Crocker-Wheeler Company has declared its quarterly dividend of 1½ per cent. The Electric Company of America has declared a regular semi-annual dividend of 3½ per cent, payable July 31. The New Telephone Long Distance Company, of Indianapolis, Ind., has declared the regular quarterly dividend of 1 per cent. The Hudson River Telephone Company has declared the regular quarterly dividend of 1½ per cent. The following dividends, payable August 1, are reported: Jacksonville Electric Company, $3 semi-annual on preferred and $3 on the common; on the Fall River Gas Works Company, $5 semi-annual; semi-annual of $3 on the Minneapolis General Electric. After passing two semi-annual dividends of $3 per share because of strikes and boycotts due to the inauguration of the Jim Crow law, etc., the Houston Electric Company has resumed dividends upon its preferred stock at the regular rate of 6 per cent. The directors have declared a semi-annual dividend of 3 per cent, payable August 1. The Columbus Railway Company's directors have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable August 1.

KINLOCH TELEPHONE CONSOLIDATION.—All details have been completed for the deal by which the Kinloch Long-Distance Telephone Company, of Missouri, absorbs the Kinloch Telephone Company, of St. Louis. The shares of the local company, representing the issued capital stock of $2,000,000, were exchanged July 7, share for share, for stock of the long-distance company. The authorized capital of the latter corporation is $5,000,000, of which $2,800,000 has been issued, including the shares exchanged for the Kinloch Telephone Company stock. The companies, while owned by the same interests, will be conducted as heretofore by separate officers. They will be financed jointly, however, and governed by the same directors. Samuel M. Kennard, president of the Kinloch company, has resigned because of ill health and the press of private business. William F. Nolker, first vice-president, was elected to succeed him. C. Marquard Forster is president of the long-distance company. One of the directors states that the reason for the arrangement was that it would considerably simplify the handling of the properties. The long-distance company is in much better position to finance future needs than the local corporation. He said that the old order of affairs frequently caused awkward situations and friction. The Long-Distance Telephone Company on July 12 filed in St. Louis a mortgage on all its properties for $5,000,000. This is covered by the authorized issue of bonds. The American Trust and Savings Bank of Chicago and George M. Galbreath are trustees for the bondholders.

MICHIGAN STATE TELEPHONE.—N. W. Harris, chairman of the board of directors, has just issued to the stockholders of the Michigan State Company the first annual report of that company. This company is the successor of the old Michigan Telephone Company, a bondholders' committee having reorganized the property somewhat more than a year ago. Since the present management took possession in February, 1904, the number of telephones has been increased from 48,778 to 70,832. The earnings of the company have also been largely increased, the statement for the year ended April 30, 1905, being as follows:

Gross earnings		$2,089,701.51
Operating expenses		1,493,656.87
Net earnings		$596,044.64
Interest on bonds and floating debt	$234,883.23	
Dividends paid on preferred stock	137,100.00—	371,983.23
Net surplus		$224,061.41

The policy of the present management is to use its net surplus for additions and betterments to the company's property, $579,955.03 having been used for maintenance expenses alone for the year ended April 30, 1905.

CROCKER-WHEELER AFFAIRS.—The officers of the Crocker-Wheeler Company have been re-elected for the ensuing year. The regular quarterly dividend of 1½ per cent has been declared, and the affairs of the company are in a flourishing condition. The officers are: Schuyler Skaats Wheeler, president; Gano S. Dunn, vice-president and chief engineer; W. L. Brownell, treasurer; G. W. Bower, assistant treasurer. The directors are Professor Francis B. Crocker, of Columbia University; Dr. Wheeler, Messrs. Dunn and Doremus, A. Foster Higgins, Herbert Noble, Thomas Ewing, Jr., F. L. Eldridge and C. A. Spofford.

NEW YORK EDISON is doing a good business. Its report for the first five months in 1905 to the end of May, including income from associated companies, is as follows:

Gross earnings (all sources)	$5,035,395
Expenses, taxes, contingency and renewal charges	2,566,100
Net	$2,469,295
Fixed charges	826,832
Surplus for this period	$1,642,463

BOSTON EDISON.—The Edison Electric Company of Boston is understood to have earned in the year ended June 30, 1905, $71,000 above all charges and 10 per cent dividends and an allowance of 4 per cent on capital for depreciation. This compares with a surplus of $75,000 the previous year, when the capital was 10 per cent less. The company had on June 30 a floating debt of $825,000, compared with $1,083,000 a year earlier.

THE MACKAY COMPANIES.—The annual meeting of Mackay Companies was held in Boston on July 11. President Clarence H. Mackay presided. There were 529,000 shares of stock represented by proxies, which were used to elect Clarence H. Mackay, William M. Cook, George G. Ward, Dumont Clarke and Edward C. Platt trustees of the Mackay Companies. No other business was transacted.

NEW YORK TROLLEYS.—The summer weather has come in to redress the traction balances of the winter. The effect of the hot weather upon the earnings of the New York City Railway, the Metropolitan Traction system, is shown in the company's gross earnings for June, which amount to $1,887,834, as compared with $1,865,065 for the same month last year, when the subway was not in operation.

GENERAL ELECTRIC SECURITIES.—Last week Harvey Fisk & Sons announced the formation of a $4,000,000 company to hold electric company stocks and bonds for the General Electric Company and offered $500,000 of 5 per cent cumulative preferred stock at 92½ and accrued dividends.

General News of the Week

The Telephone.

MARION JUNCTION, ALA.—S. A. Brice and others have incorporated the Marion Junction Telephone Company.

HARTFORD, CONN.—By a vote of 105 to 99 the bill to admit independent telephone companies to do business in this State has been rejected in the House.

BOISE, IDAHO.—The Independent Telephone Company will install a switchboard, which will cost about $20,000.

CALDWELL, IDAHO.—A franchise has been secured from the city council by the Independent Telephone Company.

TWIN FALLS, IDAHO.—The system of the Twin Falls Telephone Company, Limited, has been purchased by the Rocky Mountain Bell Telephone Company.

POCATELLO, IDAHO.—The franchise recently granted to E. C. Mason and G. D. Aiken, of this city, for the operation of a telephone system, has been acquired by the Rocky Mountain Bell Telephone Company through purchase.

ELKVILLE, ILL.—The Jackson County Telephone Company has increased its capital stock from $2,450 to $21,000.

ATHENS, ILL.—The Menard County Telephone Company has been formed with a capital of $5,000. Incorporated by M. C. Scott, T. W. Kenyon.

NOBLESVILLE, IND.—The Home Telephone Company, of this city, has increased its capital stock from $15,000 to $30,000. The increase is made necessary for the purpose of extending the lines and making other improvements. Thos. Guffin is president and Elihu Hawkins secretary.

KOKOMO, IND.—The city council has decided to table the ordinance designed to so modify the franchise of the Citizens' Telephone Company as to permit it to enter into an arrangement with the Bell Telephone Company for long-distance service. The franchise was originally secured through the influence of the Indianapolis Long Distance Telephone Company and a provision was inserted prohibiting it from entering into any sale or business arrangements with the Bell Company. The Bell people have made an offer for a controlling interest in the local plant so tempting that the owners appealed to the council for a modification of the franchise and the refusal is regarded a victory for the New Long Distance Company, which has a contract with the local company to furnish it long-distance service. The fine point in this question is whether the local company has the right to give a long distance message to the Bell Company, when such message is addressed to a point that the New Long Distance Company does not reach. It is the opinion of good lawyers that the local company can do this notwithstanding the restraining clause in the franchise.

HAVELOCK, IA.—The Havelock Mutual Telephone Company has been formed with a capital of $28,000, by W. E. Pirie and others.

EARLING, IA.—The Earling Telephone & Telegraph Company has been formed with a capital of $10,000. Incorporated by P. J. Korth and others.

ELDORA, IA.—The Iowa Telephone Company has bought the Hardin County Telephone Company's exchange and lines and has sub-leased the plant to the Eldora Mutual, entering into an arrangement with that company which gives the Iowa subscribers the use of both systems and 90 miles of toll lines.

LYNN GROVE, KY.—A new telephone company has been incorporated here with a capital of $2,000.

LOUISVILLE, KY.—The Wing Telephone Company of Graves County has been organized. Capital, $1,500.

ONAWAY, MICH.—The Onaway Telephone Company has entered into an agreement with the Northeastern Telephone & Telegraph Company, which will give its patrons at Onaway, Millersburg and other places in that vicinity toll service with all sections of Michigan. The Onaway Company is contemplating putting in an automatic exchange.

OTO, MINN.—The Farmers' Mutual Telephone Company, capital $10,000, has been incorporated by John Hilfiker and H. P. Simmons.

MISSOULA, MONT.—The extension of its system through the Bitter Root valley is contemplated by the management of the Rocky Mountain Bell Telephone Company.

HAMILTON, MONT.—The proposed grants of a franchise to the Rocky Mountain Bell Telephone Company and one to the Bitter Root Telephone Company were approved at a special election recently held here.

COLUMBIA, MO.—The Columbia Telephone Company has increased its capital stock from $5,000 to $250,000.

AUSTIN, MO.—The Austin Inland Telephone Co., of Austin, has increased its capital stock from $22,000 to $50,000.

HOOPER, NEB.—The Hooper Telephone Company has been installing telephones in the vicinity of Telbasta.

PENN YAN, N. Y.—The following officers of the Friend Telephone Company, an independent line, were elected at the annual meeting: President, Thomas N. Davis; vice-president, Elias F. Pulver; secretary and treasurer, Asahel Bottsford.

KERNERSVILLE, N. C.—The Kernersville Telephone Company has just had a new exchange and a 160 drop switchboard installed. Geo. Fulp is president of the company.

HIRAM, OHIO.—The Hiram Telephone Company, capital $10,000, has been incorporated by H. C. Hurd and Wm. Miley.

LAFAYETTE, OHIO.—The officers of the Lafayette Telephone Company are making arrangements for an installation of a common multiple system. The Lafayette Company has 2,500 telephones in this city and West Lafayette, and has petitioned the Board of Public Works for permission to lay underground wires in the downtown districts.

NEWPORT, ORE.—The Council has granted a franchise to the Yaquina Bay Mutual Telephone Improvement Company, to build, equip and operate a telephone system in the city of Newport, Ore.

OZONA, TEX.—A new telephone exchange has been installed at Ozona by J. J. Shepperd.

SHERMAN, TEX.—The Grayson County Telephone Company, which has its headquarters at Sherman, will extend its long-distance lines to a number of towns.

TEHUACANA, TEX.—The People's Telephone Company has been organized here with a capital stock of $2,000 for the purpose of installing and operating a local telephone exchange. A. L. Collins is one of the incorporators.

DALLAS, TEX.—The Southwestern Telegraph & Telephone Company has purchased the property of the Granbury Telephone Company, including the exchanges at Granbury and Glenrose and 140 miles of toll line. The company is now building long-distance lines from Fort Worth to Stephenville.

DALLAS, TEX.—The Texas Consolidated Long Distance Telephone Company, which was recently granted a franchise by the City Council of Dallas, will build a line between Dallas and Fort Worth and will tap a number of towns between the two cities. Other important extensions and improvements are contemplated by the company.

AUSTIN, TEX.—The Texas Telephone & Telegraph Company, which has its principal office at Austin, will make important extensions and improvements before the close of the present year. This company is now extending its toll lines to Brady and Georgetown. It recently completed the construction of extensions to Castell and other places. Its lines now aggregate 700 miles. C. C. Gibbs, of San Antonio, is president; W. R. Hamby, of Austin, vice-president, and A. G. Miller, of Llano, superintendent.

CHILDRESS, VA.—The Little Mutual Telephone Company has been organized.

HEATHSVILLE, VA.—The Northern Neck Telegraph & Telephone Company will build a telephone line from Warsaw to Newland. Another line is also to run to Lancaster, in order to improve the service and to establish an office at Ottoman. Extensive improvements are contemplated on the Fredericksburg line with the idea of establishing a number of offices at Colonial Beach.

MILWAUKEE, WIS.—The Walworth Telephone Exchange Company has increased its capital from $2,200 to $4,200.

SOLEDAD, MEX.—A telephone line is being constructed from Soledad to Huatusco, State of Vera Cruz. It will afford communication for a number of ranches with these towns.

CELAYA, MEX.—A new telephone system is to be installed in the city of Celaya by a syndicate of capitalists who have obtained a concession from the State Government for the purpose.

SANTA ROSALIA, MEX.—Antonio Calero has obtained a concession from the Government of the State of Chihuahua for the construction of a new telephone system for Santa Rosalia.

MINACA, MEX.—Miguel Enriquez and Damon Sanz have obtained a concession from the Government of the State of Chihuahua to build and operate a telephone line between Minaca and Guerrero.

CHIHUAHUA, MEX.—Governor Enrique Creel, of the State of Chihuahua, has granted a concession for the construction and operation of an extensive system of telephone lines in the central part of the State.

SILAO, MEX.—La Compania Noruega Mexicana, with headquarters in the City of Mexico, has obtained a concession to establish systems of telephones throughout the State. Christian Schjetnan is manager of the company.

HERMOSILLO, MEX.—The Government of the State of Sonora has granted a concession to E. W. Bristol for the construction and operation of a telephone line from Hermosillo, the capital, to La Colorado. The property and money invested in the enterprise are exempt from all State taxation for a term of years.

CHIHUAHUA, MEX.—Oton Sartorius, general manager of the Mexican General Supply Company of the city of Chihuahua, has obtained a concession from the State Government for the construction and operation of a new telephone system in Chihuahua. He contemplates building long-distance lines to Parral and Jiminez.

COMPOSTELA, MEX.—A telephone line is to be constructed from Compostela, territory of Tepic, to El Rosario, State of Sinaloa. The line is to be built under direction of the Government of the territory of Tepic. It will be used principally for the dispatch of public business relating to affairs of the Territorial Government.

MANILA, P. I.—The Philippine Commission has passed an act granting to John I. Sabin and Louis Glass, of San Francisco, a franchise to construct telephone and telegraph systems throughout the Philippine Islands. Mr. Sabin is the president and Louis Glass, vice-president and general manager of the Pacific States Telephone & Telegraph Company, the head offices of which are located in San Francisco.

Electric Light and Power.

ENSLEY, ALA.—The construction of an electric light plant by the town is probable.

MONTGOMERY, ALA.—The Montgomery Light & Water Power Company has just placed an order for additional machinery for its large plant at Tallassee, which will involve an expenditure of nearly $30,000.

CARBON HILL, ALA.—It is stated that bids will be received until July 24 for bonds to the value of $25,000 for waterworks and an electric light plant. Edgar B. Kay, Tuscaloosa, Ala., is the engineer.

OTTAWA, ILL.—The Ottawa Power Company has been formed with a capital of $5,000. James A. Seddon, Robert Gaylord and others are the incorporators.

LA GRANGE, ILL.—The LaGrange Service Company is building a large power house at Maywood. The LaGrange light and water plant will also be improved, and Sargent & Lundy, of Chicago, will prepare plans for a model power house. The pumps will be operated by electric power. An extra 150 horse-power boiler and engine will be installed to be used in case of accident to the Maywood plant.

EVANSILLE, IND.—The Evansville Gas & Electric Light Company, Evansville, Ind., is planning to erect a plant to supply power to various traction lines.

ACKLEY, IA.—The Ackley electric light and heating plant has been sold by Smith Bros. to John Rath.

BURLINGTON, KAN.—The electric light plant of this city has been purchased by G. H. Webb and G. Webb.

NORTH FAIRFIELD, ME.—The Crosby Mercantile Company is to install an electric light plant which will provide light and power for its large interests here.

HOULTON, ME.—There is a proposition to make a contract with the Maine & New Brunswick Electrical Company to furnish electricity for lighting, heating and power purposes to the town.

PLAINVILLE, MICH.—The Esele Light & Power Company has bought the franchise and the plant of the Brownell Lighting Company.

HOUGHTON, MICH.—The Houghton County Electric Light Company will install an electrically driven, vertical, triplex pump at the Franklin pumping station, capable of supplying 65,000 gallons of water every 24 hours.

TAWAS CITY, MICH.—The Tawas Mfg. Company will operate an electric lighting plant within two months. The plant is being installed by the city and the company will get its revenue out of commercial lighting.

WEST BRANCH, MICH.—W. D. Eddy has been granted a 10-year franchise to operate an electric lighting plant at West Branch. He has bought the interests of W. W. Vaughn and will at once make improvements in the plant.

PORTLAND, MICH.—The municipal lighting plant will be increased in capacity by widening and deepening the race which conveys the water for power. W. D. Fargo, of Kalamazoo, will have charge of the work, which will be completed at a cost of $3,760. The plant will be shut down for at least four weeks.

LANSING, MICH.—The annual report of the municipal lighting plant shows a material gain. The cost of operating the plant in 1905 was $34,037.02, in 1904 it was $32,991.40. The increase in receipts from private consumers was $6,941.69, the total for 1905 being $41,858.12. The total earned receipts exceeded the operating expenses by $22,821.10.

MELROSE, MINN.—Contracts for constructing the electric light plant have been awarded to the American Electric Co. of St. Paul for $6,644. Oscar Claussen, St. Paul, is the engineer.

GRENADA, MISS.—The electric light plant of this city is to be improved.

SPENCER, N. C.—The town of Spencer has voted a bond issue of $70,000 for improvements, including electric lights.

GREENSBORO, N. C.—J. M. Bandy and W. H. Terrell, of Greensboro, are the engineers in charge of the development of water power on South Yadkin River for the Southern Yadkin Development Company. The work contemplated will cost about $1,000,000.

CLEVELAND, OHIO.—C. S. Britton is having plans drawn for the new power block which will be erected on the property he recently leased.

YOUNGSTOWN, OHIO.—The Electric Supply & Construction Company, of Youngstown, has secured the contract for installing an electric light system at the new filter plant for $4,133.

GALION, OHIO.—The Crawford Gas & Electric Company has changed its name to The Crawford County Gas & Electric Company. The capital is $150,000.

OREGON CITY, ORE.—The Clackamas Power Company has been incorporated by J. T. Apperson, H. E. Cross, C. H. Dye, E. G. Canfield and I. B. Sanborn; capital, $25,000, with the object of erecting dams and developing power.

CANTON, OHIO.—The Citizens' Light, Heat & Power Company has sold out to the Merchants' Heat, Light & Power Company. The new company is composed of Canton business men who have selected Thomas F. Turner as their president.

NEWARK, OHIO.—The Citizens' Electric Light & Power Company's plant and business, of Newark, has been sold to Congressman B. G. Dawes, Col. M. M. Gillette and several other local capitalists, who have formed a corporation for the purpose of conducting the business.

PAWTUCKET R. I.—Mayor Higgins has approved the ordinance granting the J. & P. Coates Company permission to lay conduits in certain streets for the transmission of electric power to its plant on Pine Street. The company has plans for the erection of a model electric plant at tidewater.

ANDERSON, S. C.—At the annual meeting of the stockholders of the Anderson Water, Light & Power Company, Dr. S. M. Orr was re-elected president. No dividend was declared on account of the fact that profits have been largely expended in making improvements to the system.

MURFREESBORO, TENN., has granted to the City Gas & Electric Light Company a franchise and a ten-year contract for lights for the city.

CLARKSVILLE, TENN.—A movement has been inaugurated here to organize a new electric light and power company. The company will be known as the Consumers' Electric Light, Power, Heating & Refrigerating Company.

CHATTANOOGA, TENN.—The preliminary surveys for the proposed big water-power electric plant on Little River, near Blanche, Ala., are now being made. H. T. Henderson and Samuel Henderson, of Durango, Col., are the principal promoters of the enterprise. It is expected that the work will cost between $1,000,000 and $1,500,000. The company proposes to develop sufficient power to furnish the industrial plants of Gadsden, Alabama City and Attalla, Ala.; Rome, Ga., and probably Anniston, Ala. The proposed plant will be located 34 miles from Gadsden, 27 miles from Rome, and 72 miles from Anniston.

BONHAM, TEX.—The Bonham Electric Light & Power Company's plant was sold to a Dallas firm, of which J. F. Strickland is president.

CLARENDON, TEX.—The Clarendon Water, Light & Power Company has been organized with a capital stock of $50,000. L. W. Chase is one of the incorporators.

BONHAM, TEX.—The Bonham Gas & Electric Light Company has been organized with a capital stock of $100,000. J. F. Strickland is one of the incorporators.

DEL RIO, TEX.—The Del Rio Electric Light & Ice Company has been organized with a capital stock of $200,000. John M. Gray, of Del Rio, is one of the incorporators.

COLUMBUS, TEX.—The Columbus Light Company has been organized at Columbus for the purpose of operating an electric light and power plant. The company has a capital stock of $10,000.

DENTON, TEX.—The city of Denton has taken possession of the water and light plant which it recently purchased from T. J. Oliver and R. C. Storey, of Dallas, and A. F. Evers, of Denton.

GAINESVILLE, TEX.—J. A. Jones and E. E. Hull, who recently purchased the plant of the Gainesville Light & Fuel Company in Gainesville, will expend about $25,000 in making improvements.

SAN ANTONIO, TEX.—C. A. Zilker, vice-president of the Southern Ice & Cold Storage Company, of San Antonio, is promoting the organization of a company to install an independent electric light and power plant for San Antonio.

AUSTIN, TEX.—Mayor W. E. Shelley, of Austin, is negotiating with the representatives of a syndicate of Boston capitalists for the sale of the ruins of the old dam across the Colorado River here and the sale or lease of the municipal water and light plant. This dam was built about ten years ago at a cost of $1,000,000, but was destroyed by a flood in the river in 1900. It supplied power for operating the water works and electric light plants of the city.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company has been formed by J. B. Ficklen, president; A. D. Tapscott, secretary. The capital is $10,000.

RURAL RETREAT, VA.—W. C. Lawson contemplates installing an electric light plant at the Rural Retreat Mills, and will probably furnish light and power to the town.

POULTNEY, VA.—The Lake Dunmore Power & Traction Company, which recently absorbed the Bristol Electric Company, is building a steam auxiliary plant and has completed surveys for a large dam to be about a mile above its present plant on the New Haven River near Bristol. The former company operated its plant only a portion of each day, but the new concern proposes to furnish power 24 hours each day.

ST. JOHNSBURY, VT.—An important business deal has just been completed by which the St. Johnsbury Electric Company acquires the Ide water power at Passumpsic, and will erect at once a modern electric light station, using the water power to its fullest capacity. The Electric Company will then have three stations, one at the dam at the Center, which now supplies the village with the arc and commercial arc lights, the station at the Belknap dam, and the new one at Passumpsic.

SAN LUIS POTOSI, MEX.—G. A. Waddil will install a new electric light plant in the city of San Luis Potosi.

SAN LUIS POTOSI, MEX.—The Mexican Government has granted a concession to Manuel Gonzalez to establish an electric power plant on the Abra de Caballeros River, in the State of Luis Potosi.

SOMBRETE, MEX.—An American syndicate, with a capital stock of $500,000, has acquired the waterfalls in the San Pedro River, near Sombrete, and is preparing to construct a large electric power plant on the site.

TEPIC, MEX.—It is stated that the electric power plant which will be erected near Tepic for D. Aguirre & Company will cost about $75,000. It will supply the city of Tepic with lights and power and will afford power for operating the Aguirre cotton factory and other industrial concerns of the section.

TORONTO, ONT.—The Electrical Development Company has entered into contract to supply the Toronto Railway Company and the Toronto Electric Light Company with electrical energy from Niagara Falls at from $35 to $40 per horsepower per year.

The Electric Railway.

DENVER, COL.—A $75,000 electric street car system is planned for Tucson, Ariz., by W. S. Iliff and C. K. Durkin, president and vice-president, respectively, of the United States Light & Traction Company, of Denver.

WILLIMANTIC, CONN.—The Willimantic & Stafford Springs Street Railway Company has been incorporated with a capital stock of $700,000. It is authorized to construct and operate a trolley line in the towns of Windham, Mansfield, Willington and Stafford. The incorporators are Costello Lippitt, Edwin W. Higgins and Llewellyn J. Storrs, of Norwich, and Charles W. Comstock, of Montville.

FORT WAYNE, IND.—The Fort Wayne, Bluffton & Marion Interurban Railroad Company has filed a $400,000, 5 per cent gold bond mortage in favor of the Guarantee Loan & Safe Deposit Company of Philadelphia.

PORTLAND, IND. — The Muncie-Portland Traction Company has filed articles of incorporation, the capital being $100,000. The principal office will be located in Portland. A. E. Smith, Louis A. Clark, W. S. Richey and J. L. McPherson are the incorporators.

SHELBYVILLE, IND.—The Indianapolis & Southeastern Traction Company has filed articles of incorporation with a capital stock of $1,200,000, for the purpose of constructing and operating a traction line between this city and Greensburg and thence to Batesville, and also to construct and operate plants for generating and supplying electricity for heat, light and power. The incorporators are Fletcher M. Durbin, W. J. Alford, C. C. Curtis and J. H. Smith.

SOUTH McALESTER, I. T.—The Indian Territory Traction Company has passed into the hands of the Choctaw Railway & Lighting Company, capitalized at $500,000. The incorporators of the new company are M. M. Lindly, A. E. Pierce, Jr., R. L. Schieg, M. E. Williams and A. U. Thomas, of this city; W. R. Naughton, of Chicago, and E. W. McAlester, of South McAlester. A large sum will be expended in improvements.

WESTMINSTER, MD.—A project has been quietly worked up for the construction of a trolley line from this city to a point between Winfield and Taylorsville, in the southern section of the county, to connect with a line from Gettysburg, Pa., to Washington, D. C. James W. Le Gore, of Legore, Frederick County, is at the head of these projects.

WARE, MASS.—George S. Taft, receiver for the Hampshire & Worcester Street Railway, has petitioned the Superior Court for permission to sell the road.

MARLBORO, MASS.—It is announced here that the Boston & Suburban Street Railway Company, which controls a chain of roads running out of Boston, has acquired control of the Marlboro & Westboro Street Railway.

BOSTON, MASS.—William LaCroix, president of the Nahant & Lynn Street Railway, has petitioned the Railroad Commissioners on behalf of the company for authority to issue original capital stock of $50,000, the proceeds of which issue to be applied to expenses of construction and equipment.

BATTLE CREEK, MICH.—The financing of the Battle Creek & Coldwater Electric Railroad, 40 miles in length, has been arranged with a New York concern, and the construction and equipment of the road with a New York construction company.

GRAND RAPIDS, MICH.—The Grand Rapids Railway Company is to install in its power house coal crushing and conveying apparatus having a capacity of 40 tons an hour. Two or three 350-hp. water-tube boilers and automatic stokers will also be added, and extension made to the car houses.

RED LODGE MONT.—A project for the construction of an electric railway from this city to the Bear Creek coal camp is being favorably considered by Butte capitalists.

MISSOULA, MONT.—G. W. Dougherty, of Hamilton, who, as representative of eastern interests, has secured a franchise for an electric railway system in this city, announces that work will be commenced during the summer months. The line will traverse the Bitter Root valley. It is believed that the system will eventually extend as far as Anaconda and Butte.

ALBANY, N. Y.—The Ticonderoga Union Terminal Railroad Company has been incorporated to operate a street railway from Addison Junction to Ticonderoga. Then length is 5 miles. The capital is $50,000, and the directors are I. Rothschild, Altus B. Adkins, Alexander H. Weed, Frank B. Wickes, Mortimer V. Drake and Frank T. Locke, of Ticonderoga, and Frank B. Gridley and Northrup R. Holmes, of Troy.

SYRACUSE, N. Y.—The Skaneateles Lake Transportation Company has been incorporated at Albany, with a capital of $25,000. The company is controlled largely by the men back of the Auburn & Syracuse Electric Railroad Company. The new incorporation will operate a fleet of passenger boats on Skaneateles Lake in connection with the trolley line.

CATSKILL, N. Y.—The Upper Hudson Electric Railroad Company, of Newburg, was incorporated recently to operate an electric railway 25 miles long from the terminus of the United Traction Company, of Albany, in the town of Bethlehem to the village of Catskill. The capital is $500,000, and the directors are Luke F. Gillespie, J. M. Sheehan, Newburg; Eugene Wolfe, F. W. Titus, Athens; T. M. Sherman, Coxsackie; H. W. Dalton, Thompsonville, Conn.; F. J. Curnick, New York. This company is practically a reorganization of the former Upper Hudson Electric Company, which had a capital stock of $150,000. The new company probably will succeed to the franchises secured several years ago to build an electric railway down the west bank of the Hudson from Kenwood to Catskill.

DAYTON, OHIO.—The Dayton & Irvington Street Railway Company has been incorporated by M. P. Nisewonger, J. W. Bovey, F. M. Stutsman, C. J. Gever and others.

CLEVELAND, OHIO.—A permit has been issued to the Cleveland Electric Railway Company for the construction of a 2-story power house on Washington and West River Sts.

CLEVELAND, OHIO.—The Pomeroy syndicate announces that the building of the Cleveland, Ashland & Mansfield Railway is now assured. The Roberts & Abbott Company, Cleveland, is engineer for the project.

STEUBENVILLE, OHIO.—T. H. Loomis, promoter of the Canton & Steubenville Traction Company, claims to have arranged for the financing of the project, and the route of the proposed line has been adopted.

CLEVELAND, OHIO.—The proposed electric railway between Kansas City, Leavenworth, Atchison and St. Joseph, in which Denison, Prior & Co., of Cleveland, have been and are interested, is to be built. Papers of incorporation have been taken out in Missouri. The company's name is the Missouri Valley Electric Railway. The capital named is $650,000. The incorporators are: George P. Blanchard, of New York; Charles P. Breen, George B. Tuggle, S. Wilson and H. B. McAfee, of Parkville, Mo. The road will be 65 miles in length.

SHAMOKIN, PA.—Plans were formulated here last week for the immediate construction of the $1,500,000 trolley line between here and Sunbury, by New York and Philadelphia capitalists, headed by Ex-Congressman M. H. Kulp.

BRADFORD, PA.—Practically all the necessary rights of way for the building of the proposed trolley line from East Bradford up the Kendall Valley to Kew City and thence to Smethford, with a branch from Kew City to Mt. Jewett, have been secured, and prospects for the early construction of this 40-mile system are good.

AUSTIN, TEX.—Articles of incorporation of the Gainesville, Whitesboro & Sherman Electric Railway have been filed. The new company has a capital stock of $500,000, and its purpose is to build an interurban line between Gainesville and Sherman, a distance of 32 miles.

SALT LAKE CITY, UTAH.—A meeting of local promoters and eastern capitalists will be held here at which plans for an electric railway to connect this city with Murray, Bingham Junction, the valley smelters and Bingham will be discussed. The cost of the proposed system is estimated at $2,000,000. The names of the promoters are withheld for the present, but it is known that prominent local mining men are behind the enterprise.

SNOHOMISH, WASH.—All interest in the Snohomish & Cherry Valley Railway has passed from the control of the original promoters of the Snohomish & Cherry Valley Electric Railway Company into that of a new company to be organized among local capitalists. It is understood that the most active backers of the proposed company are Mayor C. S. LaForge, of Snohomish; J. B. Brown and Victor Marshall, also of Snohomish, and Milton Stephens, of the Bank of Monroe. President J. W. Hall, of the old company; W. M. Snyder, of Snohomish; E. Colburn and E. L. Colburn, also of the old company, will probably be identified with the new. E. Colburn will continue as chief engineer.

CORNWALL, ONT.—The motormen and conductors of the Electric Street Railway, of Cornwall, are out on strike. They demand an increase of four cents per hour, or from 13 to 17 cents. Manager Hodge submitted the matter to the directors in Montreal, who declared that it was impossible to comply with the demand of the men. The line is operated by the Sun Life Assurance Company, of Montreal, having passed into the hands of that company as bondholder. This company has also purchased the electric light service of the town, and by combining it with the street railway expect to make the investment profitable.

MONTREAL, QUE.—The officials of the Temiskaming Railway of Ontario, are conferring with the Locomotive & Machine Company, of Montreal, with a view of having an electrical locomotive constructed. It is intended that electric locomotives shall be used on some of the divisions of the railroad.

New Industrial Companies.

THE CENTRAL ELECTRIC COMPANY, of St. Louis, Mo., has been formed with $8,000 capital stock by J. H. Davey and G. S. Johnson.

ERWIN & COMPANY, of Chicago, Ill., will manufacture machinery and electrical supplies. Charles A. Pearson, B. M. Marks, Frederick Duffy are the incorporators.

THE GRAYSON ELECTRICAL CORPORATION, of Grayson, Va., has been formed with $10,000 capital. The incorporators are G. O. Grayson, president; J. H. Grayson, secretary.

THE ELECTRIC ELEVATOR & MILLING COMPANY, of New York, has been incorporated; capital, $25,000. Directors: Yale Kneeland, O. M. Mitchell and F. L. McLean, of New York.

THE BEACON ELECTRIC COMPANY, of Boston, has been formed. Capital, $25,000. President, B. L. Ames, Roxbury; treasurer, F. S. Ashley, Boston; clerk, W. S. Barney, Dorchester.

THE SEACOAST ELECTRIC & MFG. COMPANY, at Lanoka, N. J., has been incorporated with a capital of $50,000. The incorporators are Orian F. Lane, Daniel S. Holme, George M. Lane.

THE BUSHMILLER COMPANY, New York, has been incorporated to manufacture gas and electrical fixtures; capital, $5,000. Directors: Siegfried Bushmiller, Mary C. Bushmiller, P. A. Hatting, New York City.

THE CLARK WIRELESS DEVELOPMENT COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $20,000. The incorporators are Judson W. DePuy, William H. Bearinger and Charles Schlegel.

THE SECURITY AUTOMOBILE SIGNAL COMPANY has been incorporated in New York; capital, $1,200. Directors, U. W. V. Westervelt, Glenridge, N. J.; R. S. Hobbs, New York; Edward Van Winkle, Jersey City.

Legal.

NEW YORK FRANCHISES.—Justice Gildersleeve in the New York Supreme Court has denied the application of Franklin Pettit for an injunction restraining the Board of Estimate and Apportionment from acting on petitions for further franchises made by the Atlantic Telephone Co., N. Y. & Portchester Railroad Company, Nassau Electric Railroad Company, Southern Boulevard Railroad Company and the Union Railway Company. The court at the same time vacated the ex-parte injunction obtained by Pettit. Justice Gildersleeve, however, issued a stay directing the Board of Estimate to do nothing in the matter of petitions except to give them a hearing. The stay is to remain in effect pending a decision by the appellate division of the Supreme Court on the constitutional question raised.

SUBMARINE BOATS.—John P. Holland, inventor of submarine torpedo boats, has filed in the Court of Chancery at Newark, N. J., his formal answer to the suit brought against him by the Electric Boat Company, with which he was associated for the five years from 1899 to 1904. The answer is filed by Vreeland, King, Wilson & Lindabury, and contains besides the answer of the defendant inventor his cross bill to the complainant's allegations, in which he prays that all patents assigned by him to the Electric Boat Company be declared to be improperly held, and that the court order that corporation to reassign the same to him because of its failure to fulfill the specifications and terms of the contract under which they were assigned. He also asks that the complainant company be directed to reassign for the same reason all foreign patents granted to him and by him assigned to the company. The answer and cross bill contain allegations as to the causes leading to the want of success on the part of the company organized to exploit Holland's submarine boats. They assert that after securing the assignments from Holland of fifteen patents covering inventions for controlling the operation of the submarine boat and its armament, he was forced to the background and his advice and experience as a practical submarine engineer were wholly ignored and the management and construction of the vessels were placed in charge of engineers who, he avers, had no knowledge whatever of submarine construction, conditions or requirements.

Educational.

SOUTH DAKOTA STATE SCHOOL OF MINES.—While the school, which is located at Rapid City, S. D., in the mining district of the State, was organized with special reference to the promotion of the mining interests, its scope has been enlarged so that it now offers courses in civil engineering, general science and a preparatory course. The school possesses exceptional advantages for the study of mining engineering. The student has an excellent opportunity to study the milling and smelting processes as they are practiced at Lead City, Deadwood, Rapid City and other points in the Black Hills upon gold, silver and lead ores. The tin district is easily accessible from Rapid City.

WEST VIRGINIA UNIVERSITY.—The University at Morgantown offers four-year courses in civil, mining, electrical and mechanical engineering. The first two of these lead to the degree of Bachelor of Civil Engineering, while the last two lead to the degree of Bachelor of Mechanical Engineering. By devoting an additional year to study at the University, the candidates may receive the degrees of civil engineer and mechanical engineer, respectively. The catalogue of the University shows that during the year 1904-5, no fewer than 91 students were registered in the College of Engineering and Mechanical Arts, the total registration for the University being 1105, exclusive of 307 students in the preparatory schools at Keyser and Montgomery.

NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS.—The college offers courses in agriculture, engineering and textile industry, and for four years' work in these courses grants the degrees of Bachelor of Agriculture, Bachelor of Engineering and Bachelor of Science, respectively. The instruction given in the textile department is in the theory and practice of cotton manufacturing. The building occupied by this department is a typical cotton mill fully equipped with all the machinery necessary for manufacturing cotton yarns and fabrics from the bale to the finished product. The student is taught the theory of cotton spinning, weaving, designing and dyeing, and also the practical operation of the cotton machinery used in carrying on the different processes. Each student produces for himself cotton yarns of different numbers, cotton fabrics of different kinds from known designs and choice of colors.

POLYTECHNIC INSTITUTE OF BROOKLYN.—A distinctive feature of the method of instruction at the Institute is a series of evening courses in the departments of chemistry, chemical, civil, electrical and mechanical engineering and in the department of mathematics. These courses are conducted by means of lectures, recitations and discussions given under the direction of members of the regular departments of the Institute, and are open to all persons who are qualified to take them. Students of the courses enjoy the advantage of instruction by a board of consulting professors who are engineers in actual practice and eminent specialists in their respective lines. Their work is an essential part of the course, dealing with actual professional practice. It is similar to the professional instruction given in medical colleges by eminent practising physicians and surgeons. The year 1905-1906 will witness the inauguration of a special course of advanced lectures on the problems of transportation viewed from the standpoint of the civil, the mechanical and the electrical engineer.

ARMOUR INSTITUTE OF TECHNOLOGY.—At few institutions of learning is greater attention given to telephone engineering than at the Armour Institute of Technology, of Chicago. The work in the department of electrical engineering is divided into two courses designated as Course I, Electric Power and Lighting, and Course II, Telephone Engineering. Special efforts have been made to place the latter course on the same basis as the former, which is the equivalent of similar courses offered at other technical colleges. The department of electrical engineering is well supplied with laboratory facilities, there being numerous direct-current, single-phase and polyphase machines and an exceptionally complete equipment for telephone engineering. It is interesting to note that in this department there are registered more students than in any other department of the College of Engineering. The total enrollment of the institute for last year was 1585. In the College of Engineering there were 592 students, 216 being in the department of electrical, 122 in mechanical and 122 in civil engineering.

UNIVERSITY OF TORONTO.—The calendar of the Ontario School of Practical Science, which is affiliated to the University of Toronto, contains some interesting information on the requirements for degrees at the University. The school consists of the usual engineering departments. The regular course in each department is of three years' duration. The instruction is given partly in the lecture rooms and partly in the drafting rooms, laboratories and field. A certain amount of work is laid out for the summer vacation. The course of study in each department is general, and beyond the selection of his department the student has no opportunity to specialize. After the general course is finished the diploma of the school is granted, and the student is at liberty either to enter the active life of his profession or to spend another year in special work. This year is called the fourth or post-graduate year. Graduates electing to proceed with their studies are allowed to select two subjects from an approved list, and are required to confine their whole attention to these subjects during the fourth year. The subjects in this list are such as require a large amount of time to be devoted to laboratory and other practical work. The advanced theoretical instruction is given either at the beginning or the end of the working day in order not to break up the time allotted to practical work. During this year the student is required to prepare a thesis on some subject connected with his work. After complying with all requirements, the candidate receives from the University the degree of Bachelor of Applied Science.

Personal.

MR. C. L. EDGAR, president of the Boston Electric and Boston Edison Companies, is sailing for Europe for three months of rest and recreation.

MR. ROBERT C. REED has been appointed superintendent of the electrical department of the Duquesne steel works of the Carnegie Steel Company. He succeeds Mr. E. Friedlander, who resigned recently.

DR. A. E. KENNELLY, of Harvard University, is sailing from Boston on July 20 for England and the Continent, and he and Mrs. Kennelly will be away on this vacation trip until the end of September.

MR. A. H. WHITESIDE, who has for a considerable time been manager of the Allis-Chalmers Company's district office at Atlanta, Ga., was transferred on July 15 to the Philadelphia district office, where he succeeds as manager Mr. W. A. Wood, resigned.

MR. SAMUEL H. FRESHNEY, of Muskegon, Mich., general manager of the Muskegon Traction & Lighting Company, has been chosen by the Grand Rapids board of public works as the head of the recently organized public service department. He will enter upon the duties of the position September 1.

MR. GEORGE B. TRIPP, general manager of the Colorado Springs Electric Company, has now been made manager of the Colorado Springs Gas Company and of the Colorado Springs Light & Power Company. Large interests are held in common in these concerns, but it is said that no consolidation is intended.

MR. M. W. THOMAS has been appointed manager of the Allis-Chalmers Company's district office at Atlanta, Ga. Mr. Thomas is widely known in the South, where he has been identified for years with electrical and machinery interests. He was until recently manager of the Westinghouse Electric & Mfg. Company's office in New Orleans.

MR. A. M. BELL.—Alexander Melville Bell, the aged father of Prof Alexander Graham Bell, is seriously ill at his summer home, Colonial Beach, Va. Two physicians from Washington were summoned this week, and because of the serious condition of the patient did not wait for the usual means of transportation, but took a Government tug.

MR. CHARLES E. WADDELL, of Asheville, N. C., was a visitor to New York last week, when several members of the American Institute of Electrical Engineers seized the opportunity to reciprocate some of the hospitalities extended during the recent annual meeting in the South. A little dinner was given to Mr. Waddell at Bay Ridge, on New York bay, one evening, and among those present were President Lieb, Secretary Pope and Messrs. F. C. Bates, Calvin Rice and F. H. Gale.

MR. E. R. KNOWLES, C. E., 120 Liberty Street, New York City, has been retained as consulting engineer for the light, power and heat installations for the new factory to be erected in Jersey City for M. Calm & Bro., 41 Warren St., New York City, and also for the new factory to be erected in Brooklyn for the S. S. McClure Publishing Company. He is now making the light and power installations in the North River Insurance Company and the Gibson Buildings, New York City, N. Y.

PROF. G. F. SEVER, of Columbia University, New York, is being kept busy this vacation tallying the honors and recognitions that come his way. He received recently from Columbia an honorary degree as Master of Science, and he has also been made full professor and acting dean of the School of Applied Science at the University. On July 4 he was elected a member of the Massachusetts branch of the Society of the Cincinnati, of which famous Revolutionary body one or two of his ancestors were presidents.

MR. WM. H. BLOOD, the newly elected president of the National Electric Light Association, was in New York, last week, consulting with

several of the officers of the Association regarding the policy to be pursued during the coming year. President Blood intends to make a number of appointments of committees, etc., in the near future, with a view of having active work taken up at once, and continued throughout the year, in addition to the routine work of the secretary's office. A number of new members were added to the different classes at the Colorado meeting, and interest in the association was never so keen as at the prsent time.

MR. W. J. BUCKLEY, who has earned a widespread and enviable reputation as a successful salesman of power and electrical machinery in the Southwest, has been appointed manager of the Allis-Chalmers Company's district office at St. Louis. Mr. H. P. Hill, whom he succeeds, goes to the Salt Lake City district office, where he will devote himself to his specialty, the electrical features of the company's business. The Allis-Chalmers Company has never before had its electrical department's products directly represented in that district.

MR. C. T. YERKES.—A cable dispatch from London of July 18 says: "Charles T. Yerkes, who has been seriously ill for the past fortnight, is recovering. His illness considerably alarmed the traction interests of London. The calling in of a prominent specialist gave rise to a rumor that blindness was setting in. A Paris specialist diagnosed Mr. Yerkes's malady as dilation of the stomach and recommended complete rest. Mr. Yerkes was able to do business in his chambers yesterday. Probably he will go to the country in a few days. His condition is not causing any apprehension."

Trade Publications.

RAWHIDE BELTING.—The Shultz Belting Company, 111 Chambers St., New York, has issued a neat booklet devoted to Sable rawhide belting. The characteristic features and the advantages of the rawhide belting 'are well shown. The booklet contains valuable information concerning the size of belting for various duties.

STEAM TURBINES.—A most interesting bulletin of the De Laval Steam Turbine Company describes its factory and product, and gives a sketch of Dr. De Laval, the inventor. The bulletin is profusely illustrated, the views showing the interior of the shops at Trenton, N. J., and turbines in various stages of construction.

WATER, STEAM AND AMMONIA PACKINGS.—In a well-illustrated catalogue, the Crandall Packing Company, Palmyra, N. Y., gives a complete description of the characteristic features of the numerous styles of packing which it offers to the trade. The faith of the company in its packings is shown by the fact that it expresses its willingness to submit samples for test without cost.

LOCOMOTIVE CRANES.—The Browning Engineering Company, Cleveland, O., recently issued bulletin No. 19, devoted to locomotive cranes. It contains numerous illustrations, showing the cranes at work in stone and lumber yards, in railroad construction, in repair shops, and for handling coal and ashes. A prominent feature of these cranes resides in the fact that they are independent of a locomotive, and can be employed for switching cars.

ALTERNATING-CURRENT MOTORS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued an illustrated folder, calling attention to the various types of alternating-current motors which it is now manufacturing. In addition to its well-known single-phase constant-speed motors, the company has developed complete lines of single-phase variable-speed motors, and polyphase induction motors of the "squirrel-cage" and "external-resistance" types.

GOLD MILLING.—In its special publication No. 4000, the Allis-Chalmers Company, Milwaukee, Wis., gives an account in detail of gold milling in the Black Hills. The substance of the publication has been taken from a paper read before the American Institute of Mining Engineers by Prof. H. O. Hofman of the South Dakota School of Mines. The paper furnishes a valuable discussion of the processes involved in the extraction of gold from its ores.

WELDLESS CHAINS.—The American Annular Rolling Company, Boston, has issued in pamphlet form a translation of an article by Monsieur Eugene Francois, Professor of Engineering at the Industrial School at Brussels, Belgium, entitled "The Manufacture of Weldless Chains by the Annular Rolling Process." The pamphlet gives an excellent discussion of the relative advantages of the annular rolled chain over the welded chain, and outlines the process involved in the manufacture of the weldless chains.

NICKEL-STEEL.—In a neat booklet recently issued, the International Nickel Company, 43 Exchange Place, New York, gives a long list of the purposes for which nickel steels have been successfully applied in the United States, France, Germany and England. It is stated that the addition of 3 to 4 per cent of nickel to steel increases the proportional elastic limit, adds to the ductility of the steel, increases its resistance to compression, abrasion and shock, and increases its toughness, so that, therefore, nickel-steel is a safer material than carbon-steel.

AN ELECTRIFIED RAILWAY SHOP.—Bulletin No. 58 of the Crocker-Wheeler Company, Ampere, N. J., describes the new shops of the Pittsburg & Lake Erie Railroad at McKees Rocks. These shops are equipped with the Crocker-Wheeler Company's multiple-voltage system. The article, which was written by the mechanical engineer of the shops, shows how the designs for changing the machines to motor drive were worked up, and considers in detail some of the changes that were made. The bulletin, in addition to being of general interest, is especially valuable to any company or engineer contemplating a similar change.

RENOLD ROLLER CHAIN.—The Link-Belt Engineering Company has issued booklet No. 54, devoted to the machine-made roller chain designed by Mr. Hans Renold, of Manchester, England. This chain consists of a series of inside and outside links. The outside link is composed of two light steel plates and two shouldered steel pins, while the inside link is formed of two larger side plates, two solid bushes forming the bearings for both pin and roller, and two anti-friction rollers. It is stated that the steel is the best that the steel makers of Europe can produce, so that the weight is very materially below that of any domestic chain of equal strength.

MOTOR EQUIPMENT FOR PRINTING PRESSES.—The Sprague Electric Company, 527 West 34th Street, New York, has issued an exceptionally well illustrated bulletin designated as No. 221, which serves to show the general application of direct-current motors to printing presses and allied machines. The popularity of motors for this work will be appreciated from a study of a list at the end of the bulletin which contains more than 400 names of prominent engraving and stereotyping plants, equipped with the Sprague Electric Company's motors. The bulletin contains numerous illustrations showing the motors as actually installed with the various machines.

News of the Trade.

REMOVAL.—The Marine Engine & Machine Company, formerly at 80 Broadway, New York, has moved to 136 Liberty Street.

WESTINGHOUSE OFFICE.—The Los Angeles (Cal.) office of the Westinghouse Electric & Mfg. Company, which had heretofore been in the Trust Bldg., has been removed to No. 527 South Main Street.

THE DAYTON HYDRAULIC MACHINERY COMPANY, R. E. Spencer Geare, M. E., sales manager, has opened a New York branch office at 133 Liberty Street. It will carry a line of Brooks' centrifugal pumps, of which it is exclusive manufacturer.

THE ELECTRIC APPLIANCE COMPANY, Chicago and San Francisco, is sending out data descriptive of the Sangamo direct-current wattmeter, for which it is distributing agent. It reports that extensive additions to the factory are keeping pace with the growing demand for this wattmeter.

AMERICAN ELECTRIC FUSE COMPANY.—Contracts have been let by the American Electric Fuse Company for the erection of factory buildings at Muskegon, Mich. One building, 150x50 feet, will contain the brazing, plating, buffing and cleaning rooms and dry kiln. A three-story office building will be erected later.

MR. CHARLES R. UNDERHILL, 55 Liberty Street, New York, announces that he is now in a position to supply the trade with all kinds of small electromagnets, induction coils, spark coils and coil windings of every description and in any quantity, as well as large electromagnets and solenoids, which have heretofore been his specialty.

THE W. S. HILL ELECTRIC COMPANY, New Bedford, Mass., has recently opened an office and show room at 156 Pearl St., Boston. This was made necessary because of the increasing business in that section, and renders it more convenient for the company to show its line and submit quotations for its switches, switchboards and panelboards.

WILLARD STORAGE BATTERY.—The Willard Storage Battery Company, of Cleveland, O., informs us that since the fire in its factory, of which note was made in these pages, it has moved into a new factory, and is already turning out one-third of its usual product. This will be steadily and rapidly increased. The new factory is at 27 to 31 Academy Street Cleveland.

SOUVENIR SCARF PIN.—At the recent telephone convention in Chicago, one of the most tasteful and popular souvenirs was the scarf pin representing the trademark of the F. Bissell Company, of Toledo, Ohio. As not every one was present at the convention the company wishes to send pins to those who have not received them and will mail them on request without charge.

THE COOLEY GENERAL DEVELOPMENT COMPANY, Boston, Mass., has just increased its capital stock. This was found necessary on account of the rapidly increasing demand for the engines manufactured by this company. Some months ago it moved into its present quarters at Jamaica Plain from its old factory in Boston and now its plant is quite inadequate to the demand. The increase in capital stock is to provide additional facilities for the output of its product.

CROCKER-WHEELER LOW-SPEED GENERATORS FOR ELECTROLYTIC WORK.—An order just placed with the Crocker-Wheeler Company, of Ampere, N. J., through its New York branch, is for two size 898 Crocker-Wheeler engine-type, direct-current generators, with a capacity of 10,000 amperes and 105 volts, for electrotytic work. These will be special machines with 22 poles. The speed will be 100 r.p.m. They will be installed at Carteret, N. J., in a plant where there are at present four Crocker-Wheeler generators of varying capacity up to 750 kilowatts.

THE LONG ARM SYSTEM.—Among the few American inventions which are on display at the Naval, Shipping and Fisheries Exhibition at Earl's Court, London, this summer, a full size working exhibit of the "Long Arm" system of electrically operated water-tight power doors has attracted great attention. This system, from a central station located at a convenient point on the bridge of the ship, closes the doors and hatches of the vessel in time of emergency, providing for the local safety of men involved by a liberty action attached to each door. The device has now been installed on some 30 American men-of-war, and the Admiralty departments of numerous foreign governments are interesting themselves in the system with a view to placing it on their own ships. In addition to the exhibition at Earl's Court, there is another full-size working exhibit on display at 39 Victoria St., London.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 11, 1905.
[Conducted by Rosenbaum & Stockbridge, Patent Attorneys, 140 Nassau St.]

794,161. MEDICAL BATTERY ELECTRODE; Kittie L. Van G. Curry, Chicago, Ill. App. filed Apr. 26, 1905. A spherical electrode for a medical battery in which a pair of hemispherical sections are screwed together and provided with a chamois skin cover.

794,194. ELECTRIC CIRCUITS FOR RAILWAY SIGNALING; Henry W. Spang, New York, N. Y. App. filed July 30, 1902. In order to avoid the drop in potential which occurs when the two rails are made the respective branches of the circuit for a railroad signal, both rails are positively charged and the instruments are included in branch circuits from the rails to the ground.

794,195. ELECTRIC CIRCUITS FOR RAILWAY SIGNALING; Henry W. Spang, New York, N. Y. App. filed Sept. 30, 1902. Relates to modifications of the above in which an alarm apparatus is included in the train and the track is divided into insulated sections so that a circuit is formed between the wheels of one car and those of another.

794,196. ELECTRIC CIRCUITS FOR RAILWAY SIGNALING; Henry W. Spang, N. Y. App. filed Oct. 3, 1903. Relates to modifications of the above and displays signals upon the train by virtue of a pair of relays in the two branches of a balanced or divided circuit, a change in the balance of which actuates one or the other relay.

794,212. METALLURGICAL FURNACE; G. H. Benjamin, New York, N. Y. App. filed March 31, 1903.

794,210. DYNAMO ELECTRIC MACHINE; D. Balachowsky, of Paris, and P. Caire, of Levallois, France. App. filed Nov. 21, 1902. (See Current News and Notes.)

794,218. ELECTRIC SWITCH; Willard E. Dow, Braintree, Mass. App. filed Jan. 9, 1905. Relates to details of construction of a wall switch having two knife blade contacts within a small circular base, and an arm mounted to swing into engagement with either at will. Also includes a removable plug.

794,220. ELECTRIC CIRCUIT CLOSER; Monroe Guett, Hartford, Conn. App. filed Nov. 4, 1903. A battery switch for automobiles in which the usual removable plug is formed with cam surfaces which are adapted to engage different circuit contacts, so that the plug acts as a switch arm when in use.

794,240. ELECTRIC STORAGE BATTERY; A. Meister and A. Junker, New York, N. Y. App. filed Nov. 11, 1901.

794,242. TAPE CONTROLLED TELEGRAPHIC TRANSMITTING APPARATUS; Donald Murray, London, England. App. filed Jan. 5, 1905. A form of Jacquard mechanism in which a continuously reciprocating arm has its lateral position controlled by needles which oscillate toward and from the perforated tape. The arm closes different transmitting circuits according to whether or not the needles enter the perforations.

794,245. ELECTRIC APPARATUS FOR PRODUCING SOUND SIGNALS; Charles H. O'Brien, Augusta, Me. App. filed July 18, 1904. A buzzer or hummer for telephone apparatus in which a sort of microphone transmitter is used as a circuit breaker for a mechanical vibrator. The result is that the buzzer loses its harsh, metallic characteristics.

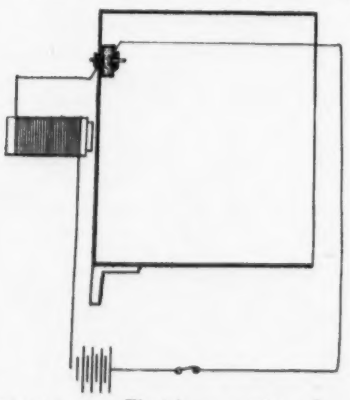
794,255. ELECTRIC FURNACE. C. L. Saunders, Cleveland, Ohio. App. filed Feb. 15, 1901. Renewed Nov. 18, 1903.

794,266. ELECTRIC SIGNALING AND ELECTROPNEUMATIC TRAIN CONTROL SYSTEM; John A. Whyte, Toronto, Can. App. filed Mar. 5, 1904. Within the locomotive cab is a switch box including means for making various circuits through the tracks which indicate whether or not the switches ahead of the train are properly positioned, and in case they are not, a pneumatic apparatus is effective to set the air brakes.

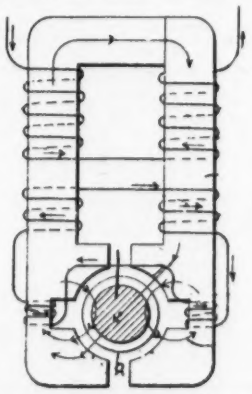
794,269. AUTOMATIC ELECTRIC RAILWAY SWITCH; Walton D. Woolley, Normandy, Mo. App. filed Aug. 3, 1904. Relates to details of construction of a track switch in which a pair of insulated sleeves are placed on the trolley wire and have connections to a pair of solenoids which throw the switch point in opposite directions. The sleeves are preferably of sheet iron, which is bent around the trolley wire and clamped with bolts on the upper side thereof.

794,321. COMBINED GUIDING AND LIGHTING DEVICE FOR CIGARS; Joseph J. Shickluna, Buffalo, N. Y. App. filed Feb. 20, 1905. The turn cock of a gas burner has an arm which makes a contact at the usual gas tip and ignites the gas. The arm also has an eye for guiding the cigar into the flame, which act also causes the operation of the device.

794,309. INSULATING BLOCK FOR ELECTRIC LIGHT CANOPIES; Isaac J. Parker, Boston, Mass. App. filed Nov. 8, 1904. Relates to a form of porcelain insulator which contains a notch or slot which slips over the edge of the usual canopy at a plurality of points and insulates the same from the ceiling.



794,245. — Electric apparatus for producing sound signals.



794,395.—Electrical measuring instrument.

794,334. WIRELESS TELEGRAPH AND TRANSMISSION ACROSS SPACE; A. Artom, Turin, Italy. App. filed May 3, 1904. (See Current News and Notes.)

794,343. TELEPHONE SWITCHBOARD; M. C. Burt, Chicago, Ill. App. filed Jan. 26, 1904.

794,348. TELEPHONE SYSTEM; W. W. Dean, Chicago, Ill. App. filed Sept. 14, 1903.

794,349. TELEPHONE SYSTEM; W. W. Dean, Chicago, Ill. App. filed Sept. 14, 1903.

794,358. ELECTRICAL CONTROLLER; Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. The controller arm has an annular cam groove which normally holds a locking plate for the reverse lever in its locking relation. When the controller arm comes to off position, the plate is released from the groove and the reverse lever can then be actuated.

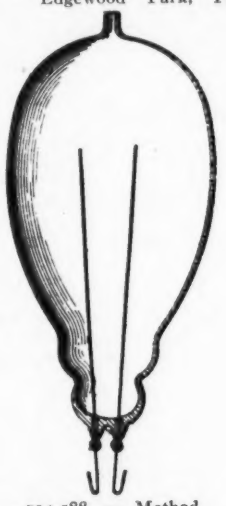
794,362. ELECTRIC MOTOR; B. G. Lamme, Pittsburg, Pa. App. filed May 3, 1904. (See Current News and Notes.)

794,363. ELECTRIC MOTOR AND CONTROLLING MEANS THEREFOR; B. G. Lamme, Pittsburg, Pa. App. filed Jan. 3, 1905. (See Current News and Notes.)

794,365. VOLTAGE REGULATOR; P. M. Lincoln, Pittsburg, Pa. App. filed June 30, 1904. (See Current News and Notes.)

794,370. TELEPHONE LOCK-OUT MECHANISM; T. Matheny and R. C. M. Hastings, Athens, Ohio. App. filed July 22, 1904.

794,395. ELECTRICAL MEASURING INSTRUMENT; Frank Conrad, Edgewood Park, Pa. App. filed Jan. 20, 1904. An alternating-current ammeter in which the torque on a pivoted rotor indicates the strength of the current. In order to avoid the error in current reading due to a change in frequency, additional coils are provided which act as secondary windings of a transformer and exert a neutralizing action as the frequency increases, so that the torque on rotor does not increase unless there is an increase in the actual current.



794,588. — Method of manufacturing incandescent electric lamps.

794,398. ELECTRIC DRILL MOTOR; Francis E. Drake, St. Louis, Mo. App. filed Sept. 30, 1904. The drill is actuated by a pair of alternately acting solenoids in the usual way, and a fan motor forming part of the device delivers a current of air to keep the coils cool.

794,423. APPARATUS FOR CONTROLLING TRAFFIC ON RAILWAYS; Thomas H. Patenall, Wilkinsburg, Pa. App. filed Oct. 18, 1904. In order to avoid excessive wear of the first few staffs in the usual form of staff instrument, the staffs operate in an endless groove, being inserted at one end thereof and taken out at the opposite end continuously. The circuits are arranged to suitably lock the staffs from withdrawal unless duly authorized in the usual manner of staff instruments.

794,435. THERMAL CUT-OUT; Theodore Varney, Pittsburg, Pa. App. filed June 24, 1904. A fuse plug in which the fuse wire is led in a curved path over a projection so that when the fuse is blown the arc will blow directly out of the chamber and will not injure the contact plates.

794,441. COMBINED RAIL JOINT AND BOND; Benjamin Wolhaupter, Chicago, Ill. App. filed Nov. 28, 1904. A form of rail joint in which a base plate has longitudinal grooves to hold and protect the rail bonds. The fish plates have underlying flanges to hold the base plate in position.

794,442. CONTROLLER FOR ELECTRIC MOTORS; Frederick Wright, Fishkill, N. Y. App. filed Feb. 10, 1905. A switch for grouping storage cells into series or multiple arc in order to control the current for any apparatus used.

794,458. INCANDESCENT ELECTRIC LAMP SOCKET; Louis C. Gollatz, Providence, R. I. App. filed Dec. 14, 1904. An adapter for the sockets of an obsolete type of incandescent lamps by which they are made capable of receiving the usual type of incandescent lamp. The device is made to automatically lock in position, so that the adapter will not unscrew and be thrown away with the lamp.

794,459. WIRELESS TELEGRAPHY; W. S. Hogg, Washington, D. C. App. filed May 6, 1905. (See Current News and Notes.)

794,466. EDUCATIONAL TOY; Hanson Robinson, Hanover, Pa. App. filed Aug. 6, 1904. A hollow sphere is partially filled with liquid and has a float therein with a permanent magnet which is adapted to maintain a toy ship upon the upper surface of the sphere, no matter how much the latter is rolled about.

794,497. THERMOSTAT; John D. Gould, New York, N. Y. App. filed Oct. 8, 1904. A circular base plate attached to the ceiling has a pair of spring blade contacts, and a plug at the center of the base is normally effective to keep the contacts separated. When a fusible cap softens, the plug moves to close the alarm circuit.

794,501. STORAGE BATTERY GRID; M. Heisser, Chicago, Ill. App. filed July 5, 1904.

794,518. CIRCUIT BREAKER; John B. Laing, Sun, W. Va. App. filed Mar. 28, 1904. A plate of insulating material has clamps at each end thereof for the attachment of trolley wire sections. The plate also has contact strips on its lower edge which form continuations of the trolley wire sections, and which can be electrically connected by a removable plug in the plate.

794,519. AUTOMATIC BLOCK SIGNAL SYSTEM; Jorg Lanz, Rodaun, near Vienna, Austria-Hungary. App. filed Jan. 21, 1903. An overlapping block signal system in which the semaphore operated by the guard only allows a train to pass out of the section traveled upon when the signal bell and release relays of the next block section are operated by the current of the battery of the next but one block section.

794,565. ELECTRIC ARC LAMP; Marion A. Stogdill, Indianapolis, Ind. App. filed Oct. 26, 1904. Relates to detail improvements in the feeder mechanism for an electrical lamp in which the solenoid acts upon a compound lever system including a toggle joint, so as to secure a more gradual movement of the carbons, while the arc is in operation.

794,580. AUTOMATIC ELECTRIC HEAT CONTROL; James I. Ayer, Cambridge, Mass. App. filed Feb. 6, 1905. The holder for a self-heating electric flatiron has a thermostat which automatically opens the circuit when the heat of the iron is sufficient.

794,588. METHOD OF MANUFACTURING INCANDESCENT ELECTRIC LAMPS. Henri Casassa, Milan, Italy. App. filed Jan. 4, 1901. A method of sealing electrodes into an incandescent lamp which avoids the necessity of platinum. The wires are fused into the glass at a red heat by which the air is expelled around the wires and a coat of oxide formed. When the bulb is exhausted a compound of linseed oil and rubber is sucked into the joint, which compensates for the varying coefficients of expansion of the glass and the conducting wires and forms an efficient seal.